POPULAR SCIENCE

MONTHLY

AUGUST

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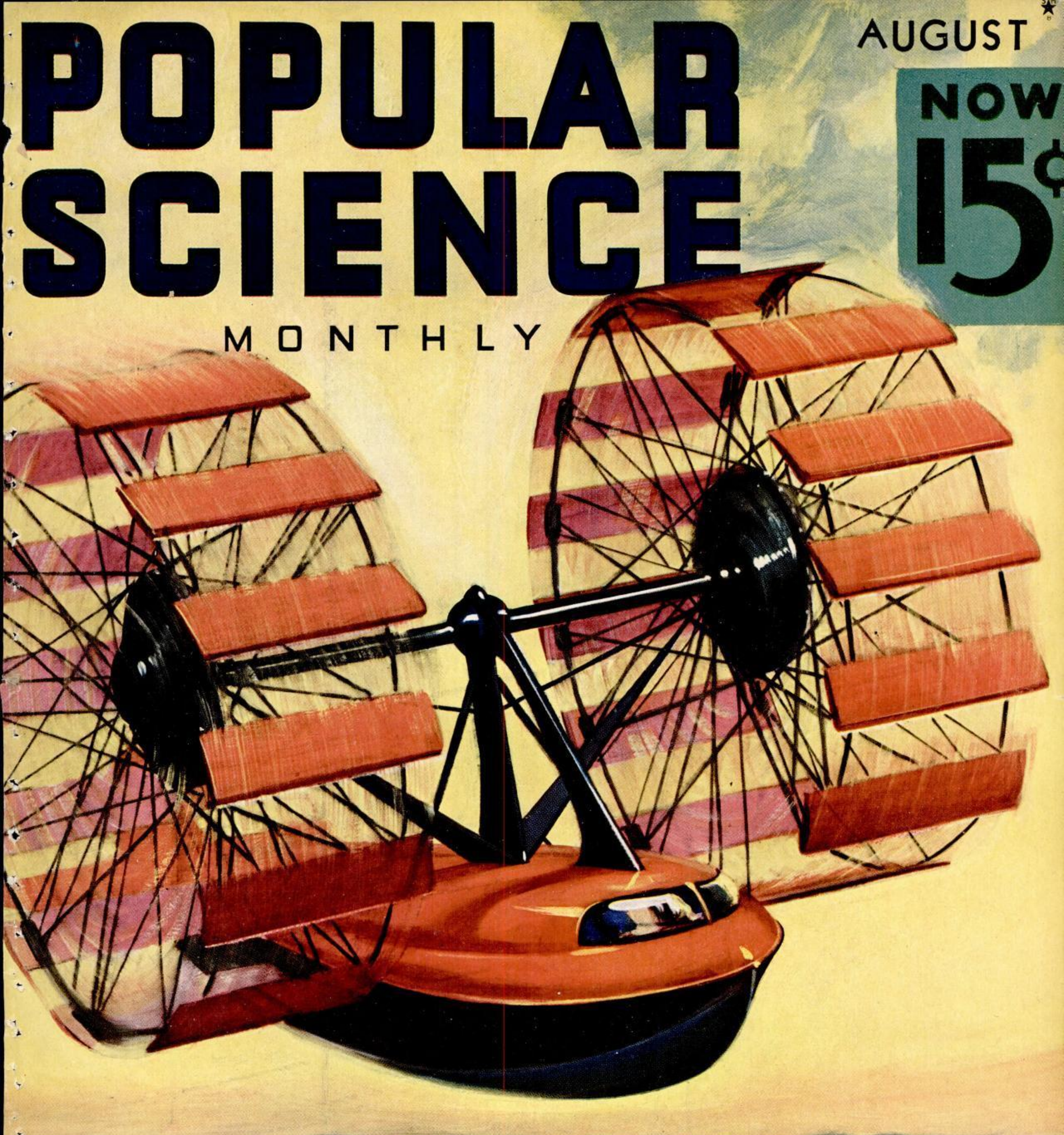
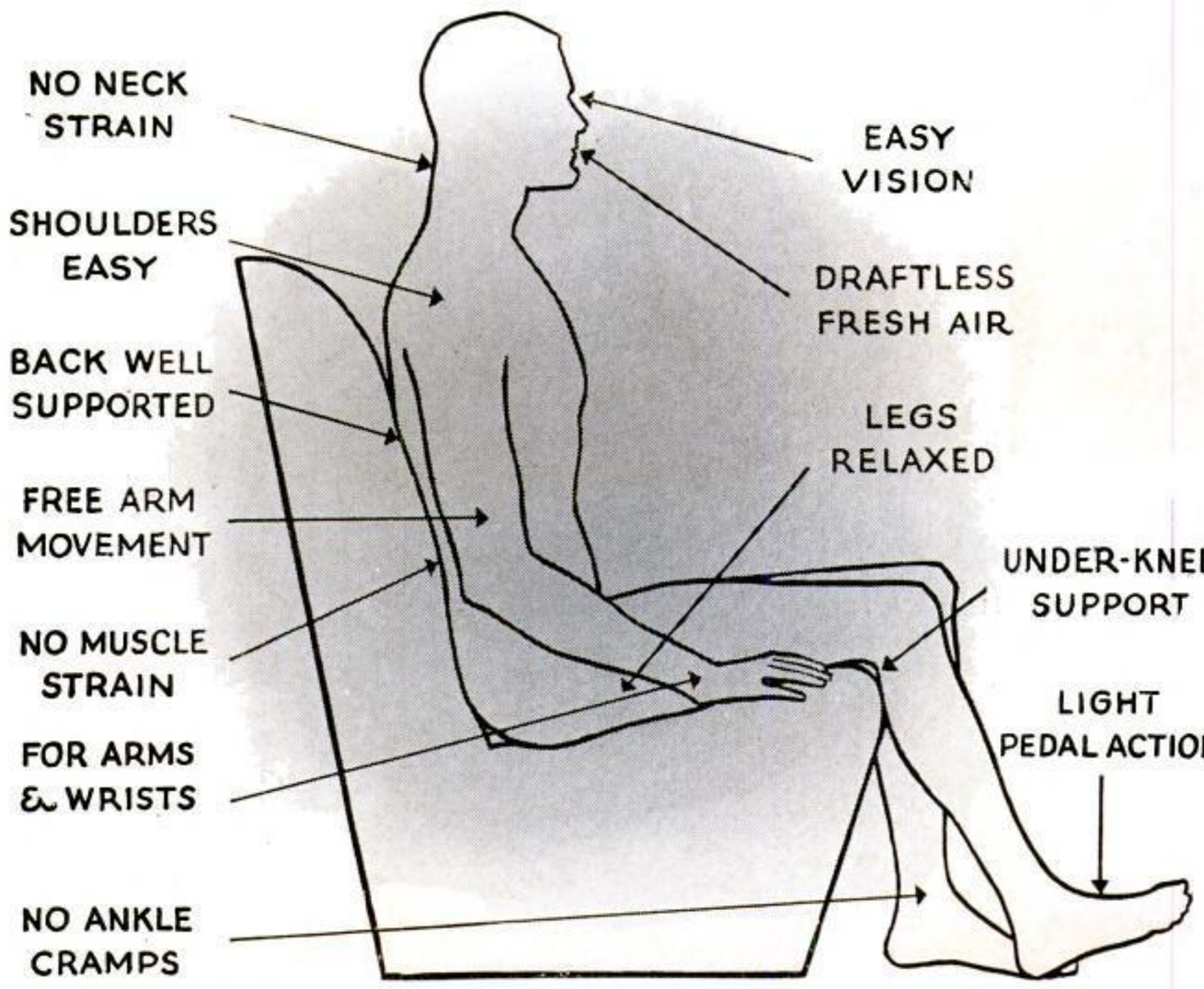


See Page 37

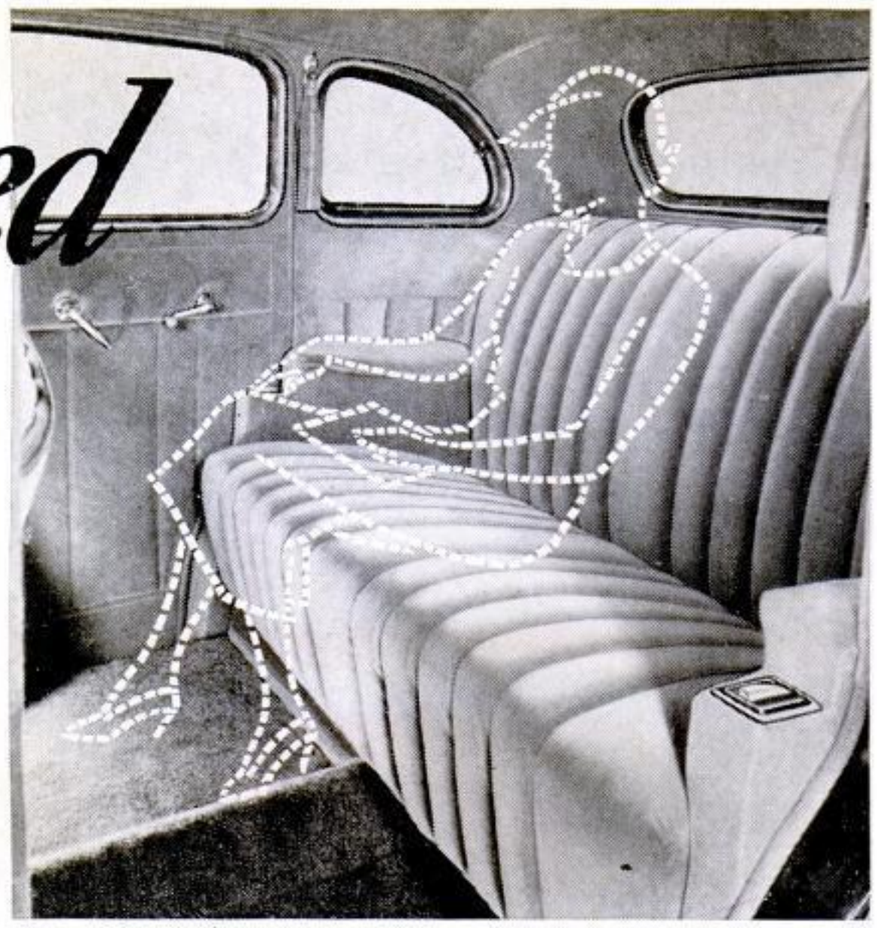
NEW INVENTIONS · MECHANICS · MONEY MAKING IDEAS

HOME WORKSHOP PLANS AND HINTS · 350 PICTURES

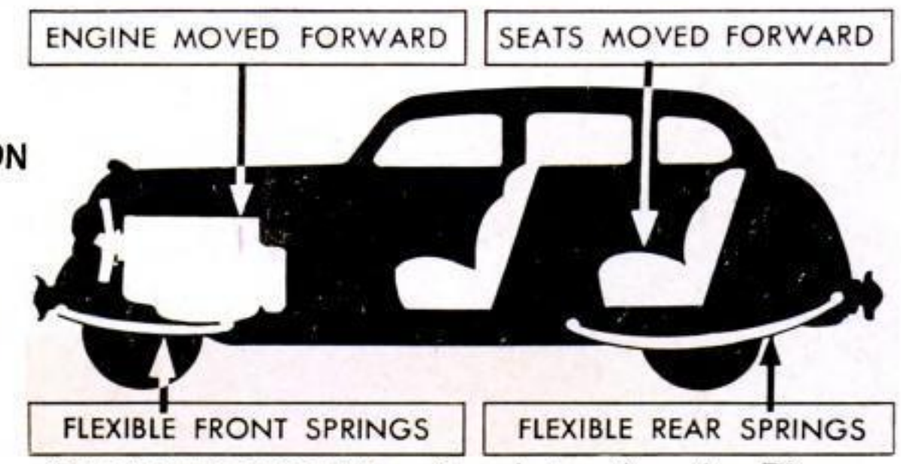
Cars now *Tailored*
TO SUIT THE HUMAN BODY



DRAWING SHOWS how carefully engineers have designed Plymouth so as to permit full comfort for the driver, as well as passengers...chair-height seats allow an easy, natural position with no strain or fatigue.



(*Above*) COMPLETE RELAXATION in Plymouth's deep-cushioned, luxuriously appointed interior... ample room for 3. More flexible ventilation makes Plymouth cooler in summer, warmer in winter.

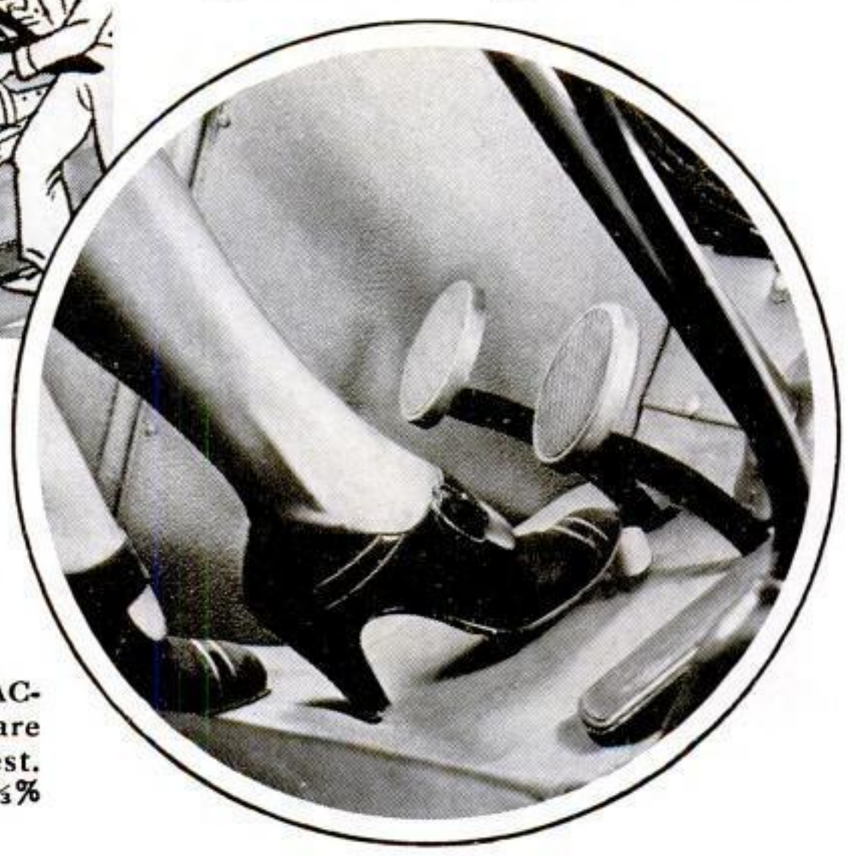


BALANCED WEIGHT and spring action give Plymouth its famed Floating Ride.

(*Above*) NOISE INSULATION—Like a blanket of rubber, special insulation separates steel body from the frame...keeping out noises and road roar. You glide along comfortably . . . quietly, and can converse in an ordinary tone of voice.

• • •

(*Right*) EASIEST CLUTCH AND BRAKE ACTION— *Double-action* Hydraulic brakes are always easiest to apply . . . as well as safest. And Plymouth's air-cooled clutch is 33⅓% easier than in some cars today.



Engineering Genius Today Provides a Low-Priced Car with New Factors Scientifically Designed for Comfort

IT'S HARD to realize that a motor car can be actually "tailored" to fit bodily comfort. Yet it is being done today...and people who take their first ride in a 1936 Plymouth car, find this a delightful surprise.

The first step by Plymouth engineering genius was the application of Floating Power engine mountings to eliminate vibration. Then they balanced car weight...equalized front and rear spring action for smooth riding at any speed, even on rough country roads.

They scientifically "pitched" and proportioned the seats to support the body in relaxed comfort. Extra leg room was provided...extra inches of width for shoulders and elbows.

Finally, by an important series of engineering developments, the driver was given easier-acting clutch, gear-shift and steering.

Plymouth is famous for its great safety features...it is still the only one of "All Three" low-priced cars with both Safety-Steel body and *double-action* Hydraulic brakes.

Priced with the lowest...$510 and up, list at factory, Detroit (special equipment extra). Terms as low as $25 a month at any Chrysler, Dodge or De Soto dealer.

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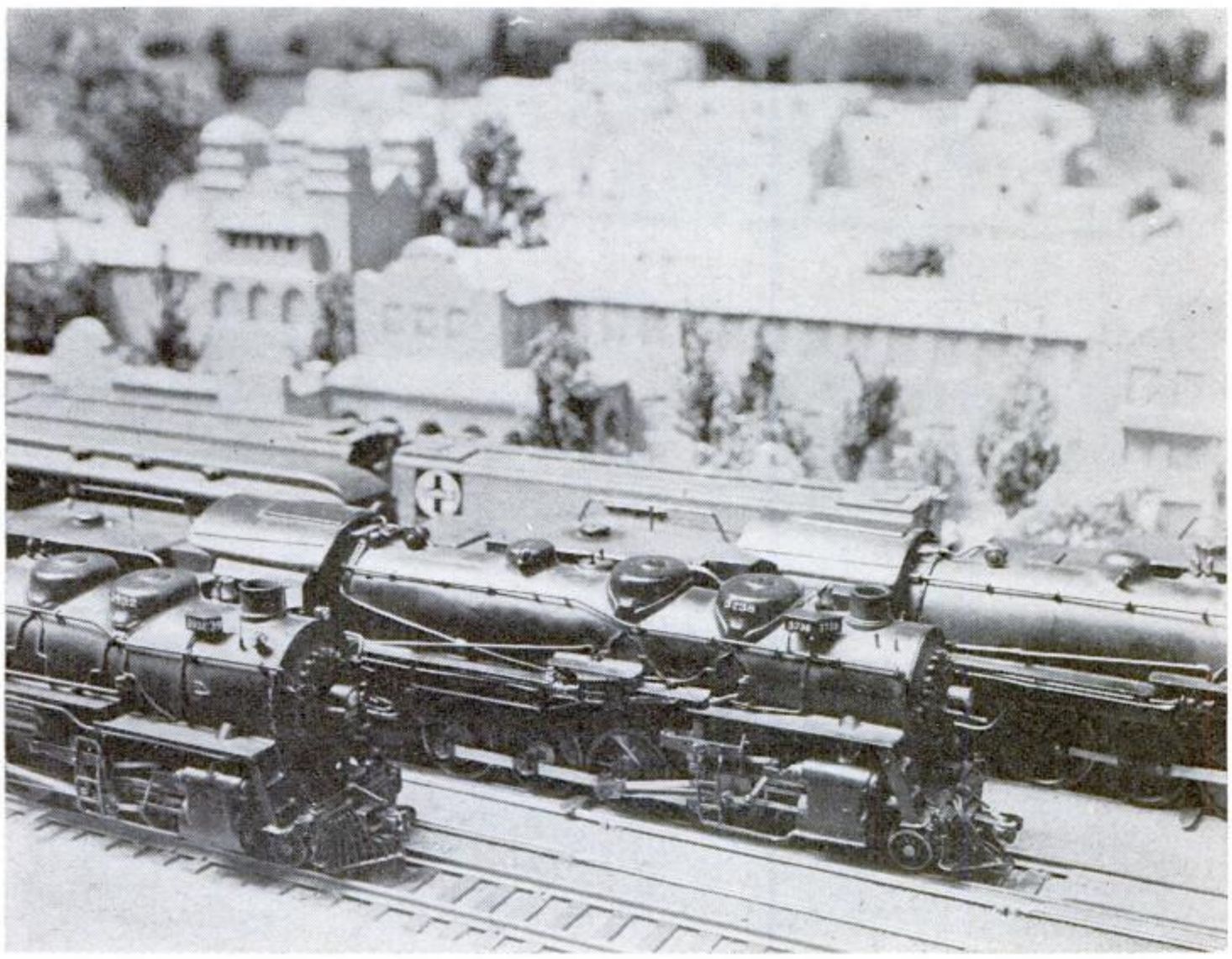

How Good Are Your Eyes?

You'll get a thrill of power and speed as the transcontinental limited flashes along ribbons of steel, plunges through dark tunnels and finally pulls up at Albuquerque. Perhaps if you are a romantic soul you may hark back to the pioneer days of railroading . . . to daring train robbers and robust plainsmen handy with a six-gun. But wait . . . don't let your imagination run too wild. There's something about this particular sequence in the latest *"Popular Science"* movie that isn't altogether cricket. What is it? Well, we won't spoil things for you by revealing it here. See *"Popular Science"* at your neighborhood theatre and enjoy the mystery first-hand. This new sound-and-color short by Paramount is full of surprises that are as interesting as they are startling. For example, *"Popular Science"* shows you waxed fruit you can really eat . . . a new high-speed industrial movie camera taking more than 12,000 pictures a second . . . how perfect spectacle lenses are made . . . amazing new labor-saving devices for the kitchen. Take the whole family to see *"Popular Science"*. They will enjoy it as much as you will.

A Paramount Picture

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FEATURES AND DEPARTMENTS

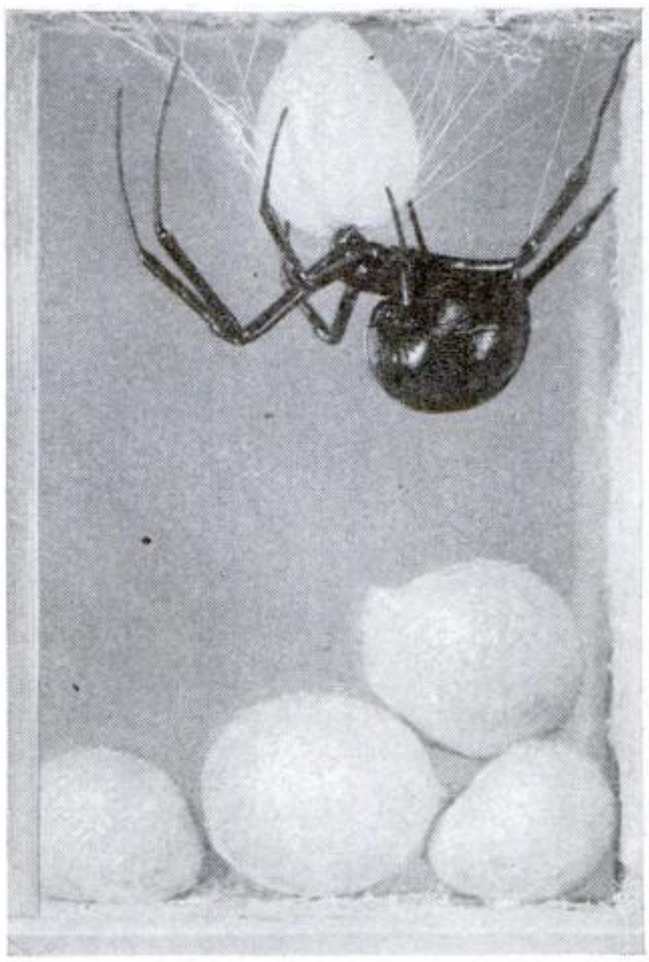
Cover Design by EDGAR F. WITTMACK

AUTOMOBILES

AVIATION

POPULAR SCIENCE MONTHLY FOR AUGUST, 1936

The Private Life Of the Black Widow



EVERY season, the average Black Widow spider makes five egg sacs like these. Since each sac contains about 300 eggs and most of the spiderlings live to maturity, each mother produces about 1,500 potential poisoners in a year. See the fascinating pictorial history of this insect beginning on page 32.

NEW CALKING COMPOUND

CRACKS around doors, windows, and chimneys can be filled easily and with a minimum of muss with a recently developed calking compound. Supplied in a long, thin paper tube instead of a can, the material can be applied without special calking tools. The paper tube, perforated along one side, is simply placed over the crack and pressed into the opening with the fingers. The pressure serves to break the perforations and forces the compound into the crevice. According to the inventor, his method reduces waste and insures a water-tight joint.

MODERNIZING OLD LIGHTS

ANY exposed bulb can be transformed into a scientific, indirect-lighting unit through the use of a new combination adapter socket and globe costing only a few dollars. The adapter socket, provided with a screw plug, is simply substituted for the electric-light bulb in the existing fixture or on a hanging drop cord.

HANDY AIDS FOR Home Owners

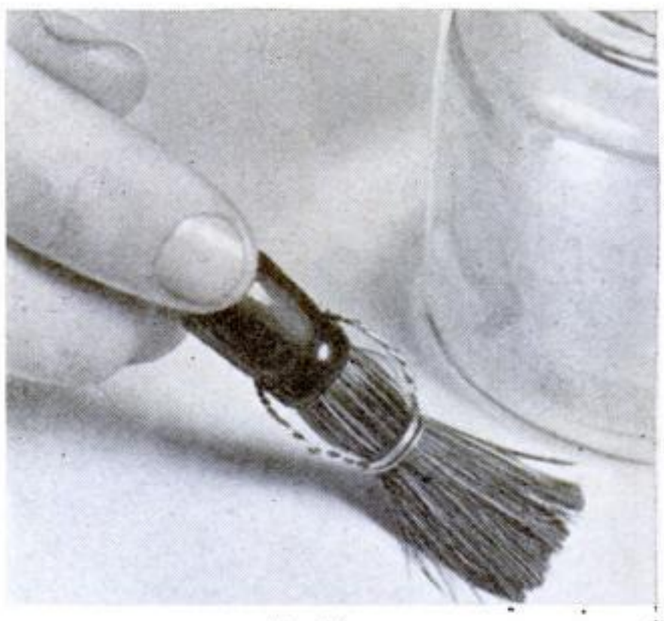
HOLDER FOR STEEL WOOL

STEEL wool used in refinishing work can be handled easily and safely with a new holder now on the market. Made of rubber, the holder is provided with four metal pins that grip the steel-wool pad tightly. Squeezing the sides of the holder bares the pins and allows the pad to be slipped into place.

When steel wool is used in refinishing work, this rubber holder will protect your fingers from steel splinters. Four metal pins, exposed by squeezing the holder as shown above, hold the wool securely in place

LONG-LIFE GLUE BRUSH

A WIRE loop fastened around the bristles of a new glue brush greatly increases the useful life of the tool. When the brush has worn too short for efficient use, the loop can be cut to expose another inch of usable bristles. The brush is said to be no more expensive than the conventional types on the market.



Questions
FROM HOME OWNERS

Q.—IS THERE any easy way to freshen up stucco without repainting?—R. C. Trenton, N. J.

A.—IF THE stucco surface is not too dirty, a large portion of the dust and soot can be removed with a stiff-bristle brush. The surface also can be cleaned effectively by scrubbing with a soap-and-water solution, although this method requires a good deal of care to prevent smudging and streaking. Incidentally, special paint soaps are available on the market.

LEAKS NOT ALWAYS TO BLAME

T. B. H., ST. LOUIS MO. Damp spots on inside walls are not always caused by leaks. Very often, particularly when the weather is muggy, they are due to the condensation of the moisture in the air on the cold plaster.

PAINTING A CHIMNEY

Q.—I INTEND painting the outside of the brick chimney on my house. It has never been painted before. Is it necessary to prepare the brick surface in any way before applying the paint?—J. L., Washington, D. C.

A.—CLEAN the brick thoroughly, being particularly careful to remove any efflorescence, or white spots (P. S. M., Mar. '36, p. 7). Then, after you have applied a priming coat of boiled linseed oil and turpentine, mixed half and half, the surface is ready for the paint. If any portion of the mortar between the bricks is new, it should be treated with a solution of zinc sulphate.

MATCH MARKS ON WOODWORK

F. T., CHICAGO, ILL. Match scratches generally can be removed from woodwork by rubbing the marks with a slice of lemon, then with whiting, and finally with soap and water.

PAINT FOR WROUGHT IRON

D. L. P., SACRAMENTO, CALIF. A good paint for decorative wrought-iron work can be made by mixing graphite with equal parts of varnish and turpentine. Apply it in thin coats.

SHINGLE SIZES

Q.—ARE wood shingles available in more than one size? In laying a roof what proportion of the shingle should be exposed?—A. C. W., Hartford, Conn.

A.—SHINGLES usually are sold in sixteen, eighteen, and twenty-four-inch lengths. They should be laid to expose four and one half, five and one half, and seven and one half inches, respectively. When cost is an important factor, they are sometimes spaced so that the exposed area is larger, but this is false economy since it results in a thinner and less durable roof.

PATCHING WALL PAPER

S. B. W., BUFFALO, N. Y. About the only way that a crack or rip in wall paper can be repaired without removing the entire section is to paste a strip of wall paper two inches wide over the entire length of the crack, taking care to match the figure. This will form a particularly good job in corners where the wall paper sometimes rips due to uneven settling of the two wall surfaces. Wall paper that has come loose from the plaster in spots can be made firm by making a small slit with a knife and injecting the necessary paste with a small ear syringe.

Our Readers Say

Thinks Motor Cars Might Take Their Alcohol Straight

You hear a lot of talk these days about finding a substitute for gasoline as a motor fuel. Several foreign countries have laws requiring the use of an alcohol-gasoline blend for this purpose. Some prominent chemists advocate that we do the same thing in this country. Now the idea behind this, as I understand it, is to conserve our oil supply and to help the farmers who would grow the crops to produce the alcohol. What I can't understand is why alcohol itself should not be used as a motor fuel. If the automobile engine had to be changed to do it, wouldn't such research be worth while because, if successful, the benefits would be two or three times greater than those that would result from the use of an alcohol-gasoline blend? I have never read a statement saying enough energy could not be obtained economically from alcohol.—H.A.D., Baltimore, Md.

Would Dig Up the Roots Of Our Family Tree

Sometime in the near future I would like to see an article tracing the evolution of the young American of today—how intermarriage in this country has or has not produced what might be called the typical American. Perhaps a story based on a survey in twenty or thirty cities in various parts of the country would give the answer. Also, I would like to read in this article some of the interesting background history of the development of races. For instance, what is the oldest pure race extant today? There are many fascinating side lights to be told in such a story.—L.S., Alma Center, Wis.

Wants a Pipe Organ That Won't Tie Him Down

To the growing list of those who want to see articles on organ building, I would like to add my name. I judge from the recent request of A.P.C., of Rumney Depot, N.H., that he would have you publish plans for a combination organ, phonograph, refrigerator, and clock with a hook-up for a motor to drive the works thrown in for good measure. I would be satisfied with just the organ. I believe some sort of an electronic organ would best meet the needs of most readers because even a small pipe organ requires considerably more space than can be spared in the average home. The electric or electronic organ has the advantage also that none of its operating parts has to be built into the house. This is a real consideration in a case like my own where the house is rented.—F.E.B., Middleboro, Mass.

An Echo From the Plane That Flies Like Sound

In a recent letter, G.T.M., of Cambridge, Mass., asked what would you hear if a plane, capable of traveling at the speed of sound, went by at full speed. I'm afraid G.T.M. has made himself dizzy by asking a foolish question. If he would stop to think for a moment that sound, in the form of waves, emanates from its source in all directions he would realize that he would hear the plane go by just as he hears present-day planes soar overhead. For some reason or other G.T.M. appears to be stuck with the idea that a plane traveling at the speed of sound would cause the sound waves to "freeze" and be carried along with the plane whereas, of course, a "trail" of sound would be left as from any other moving object emitting sound.—W.U., Wichita, Kans.

Club Houses for Crows To Keep Birds Off Wires

A friend of mine who works for a power company tells me that one of the big problems in maintaining rural power lines is caused by crows sitting on the wires. Out in the open country, where the poles are pretty far apart, the birds stretch the wires, or even break them, with their weight. Several volunteer inventors have tackled the problem, usually working on the idea of making the wires so uncomfortable that the birds will look for a more hospitable roosting place. I think a better idea is to set up crow resorts along the power lines, offering luxurious lounging places, free corn, and other inducements to lure the crows away from the hard, cold wires. Maybe some of your inventive readers can think of a better solution for the problem. There ought to be a fortune in it for the fellow who can work out a really practical system—O.O.M., Louisville, Ky.

Suggests a Fire Ladder With Elevator Service

For years I have had an idea for a more efficient and up-to-date fire ladder than the conventional ones now in use. Since I did not have sufficient funds to build a working model and secure a patent, my idea remained a mental plan. In a recent issue, however, there appeared a picture and news item about a 164-foot extension ladder and special fire truck recently put into service at Buenos Aires, Argentina. This is a step in the direction of the rescue device I have in mind, but my idea is to have a combination telescopic ladder and elevator. The ladder would be so constructed that a cage-type elevator could operate on the side girders of the ladder and sufficient space would still be available at the sides for the ladder structure. Rescued persons could be lowered safely in the elevator and the firemen would have ample ladder space. The whole device would be mounted on a special truck and there would be the necessary hoisting machinery to operate the elevator.—R.D., New York City.

Replace Your Cast-Offs With Cast-On Clothes

Not long ago, it was announced that in the future men's suits will be poured on them! A new cellulose compound is being perfected which will make this possible. According to the prediction, a man will step into a tailor's shop and have a form adjusted on him. The "liquid garment" will be poured on the form. Removed after cooling, the "poured suit" is literally a molded form of the man's figure and needs only trimming to finish. It looks like we're all destined or doomed to be dandies.—B.B., Chicago, Ill.

Another Champion Of the Steam Car Speaks

R.W.H., of Holland, Mich., takes a rather positive stand in regard to gasoline-powered automotive vehicles. Possibly he works in an automobile factory or owns oil stock. Certainly, he never drove a steam car. Granted the steam car was no vehicle to be trusted in the hands of an unbalanced man or woman due to its intricate working parts, any of these cars formerly manufactured would give a better ride than present-day automobiles. Did R.W.H. ever drive a Doble steam car? It would go any place where its wheels could get traction and travel at a speed faster than you would dare to drive it. The steam car did not pass out of the picture because of any faults in the car.—G.F.T., Fort Wayne, Ind.

Lawn-Cutting Slave Wants Stunted Grass To Free Him

Along about this time every summer, I get fed up on the job of mowing the lawn but do nothing about it—except grumble. This year I'm going to try to start something by passing on a suggestion to you. It's a chance for you or one of your readers to do something big for humanity. Here it is: Develop a strain of dwarf grass which never grows high enough to need cutting, or one which grows so slowly that it requires cutting only three or four times a season. You might think this is a hare-brained idea, but before you laugh think of some of the remarkable results already produced by crossbreeding. If they can produce a grape without seeds and string beans without strings, why

not my pygmy grass? In the meantime, I must get busy and finish the job of mowing my lawn.—T.O.C., Philadelphia, Pa.

Australian Checks Up On Fish's Feeling

THE Our Readers Say pages certainly bring forth some red-hot ideas. I have a large number of cold-water and tropical fish and would appreciate articles on aquatic life, aquarium construction, and artificial means of heating aquariums. From my experience in this field, might I say, in regard to the question whether or not fish feel pain, that I have demonstrated by several tests that fish feel pain just as much as humans or animals do. —C.F.P., Auburn, Australia.

He Likes Them All— Especially Glass Blowing

I NOTICE that some readers want articles on bacteriology, some on fencing, and others on glass blowing, and how to prepare organic chemical compounds. I am interested in all these subjects myself and perhaps you can find some way to include them in future issues. An article on glass blowing, I feel sure, would interest and help a great many readers. —R.J.C., Berwyn, Ill.

What, We Wonder, Is Wrong With Greenwich Time?

ALTHOUGH knowing little about the technical side of radio and the complexities of broadcasting, nevertheless I am going to make two suggestions in this field. Possibly both are old or impractical. First, I suggest that a new time system be inaugurated for radio broadcasting. Select some place, such as Washington, London, or Paris, and designate it as the center or determining point for a common world-wide time system. It should be called officially Marconi time in honor of Guglielmo Marconi, the inventor of wireless telegraphy. The public would probably nickname it "radio time." All radio programs should be announced and printed in this time in lieu of the various time-zone designations now used. I venture to state that as quickly as the public became used to it, it would be adopted by air-transport, railway, and steamship companies. Second, I suggest that radio stations in broadcasting sports events make it possible for the radio listener to hear more of the actual background noises in the stadium, baseball field, or boxing arena; without, of course, interfering with the announcer's words. Such a change would add to the thrill of listening to these broadcasts.—P.W.C., Madison, Fla.

Birds and Beasts Would Adorn His Wood Projects

LET'S have one or two pages devoted to modern taxidermy. On this page or pages plans could be given for constructing book ends, gun racks, barometers, thermometers, calendars, and lamps which make use of mounted animals, birds, reptiles, or sections of them for decoration. I am sure many readers would enjoy and make use of such an article. Incidentally, I find the magazine excellent for wood-working projects. —A. L., Rock, W. Va.

Model Builder Supports Plea Of Railroad-Minded Colleague

AS A dyed-in-the-wool reader of your magazine, I was glad to read in a recent number that M.M.O., Jr., Boston, Mass., wants more articles on model railroads. A boat and an airplane from time to time are all right but why not also give us short but good articles on model railroads? For my part, I suggest, as one phase of this work to be covered, the building of railroad engines and coaches from sheet metal or, if possible, from both metal and wood. Somehow, I hope you will find a way to satisfy your many model-railroad readers by adding such a series to the interesting articles that regularly appear.—P.D., Montreal, Canada.

Advocates Supreme Test In "Motorists' Clinic"

HERE'S a suggestion for the scientists who worked up the various devices for testing drivers, described under the heading "Clinic for Motorists" in your last issue: These fellows have covered the ground pretty well, with their tests for brake reaction, steering, and so on, but the greatest driving hazard they have overlooked completely. To remedy the defect, I would suggest a back-seat-driver-reaction test, to be designed somewhat along the lines of the accompanying drawing. As you see, the subject sits at a dummy steering wheel, trying to steer, brake, and do the other things included in the tests. Behind him is a phonograph which keeps repeating, "Don't drive so fast! Are you sure this is the right road? Look out for that dog! Can't you go any faster? What's that funny noise?" and so on, over and over again. The point of the test is to see how long it will be before the subject picks up a jack handle (placed conveniently beside him) and smashes the phonograph. Thirty minutes would be considered excellent.—A.T.A., Birmingham, Ala.

Putting Awnings In Their Place

BUILDERS tell us about the many improvements which will be found in homes when and if a building boom gets under way. But in none of their rosy predictions have I read anything about an easier way to raise and lower awnings. This is an awkward job, at best. Usually you have to hold the window screen in a raised position with your shoulder and then, with your body in a corkscrew twist, you tug at the ropes of a stubborn awning. My suggestion is to have a built-in, dustproof, water-tight compartment above each window and porch where a roller-type awning would be hung. The necessary rod and gears to operate it would also be built in, and all the householder need do to get his awning up or down would be to turn a small crank, like on a motor-car window. And there would be no seasonal job of putting up and taking down awnings.—A.F.Y., Newark, N.J.

Why Not Run the Bicycle With the Extra Current?

PLANS for making an inexpensive six-volt bicycle generator, as recently suggested by J.N.K., of St. Paul, Minn., would, I am sure, be welcomed by many bicyclists. An improvement to J.N.K.'s suggestion would result if the midget storage batteries described on page 53 of the June number were used. With these, a reduced speed could be maintained at night, when the generator need not be working, and the batteries would supply the current. Of course, there would have to be some means to prevent overcharging. Innovations are being introduced in all branches of transportation, so why not for bikes?—D.L.G., Rome, N.Y.

He'd Have Jacks Pop Out of Car Chassis

FANCY trimmings and bigger and better speedometer dials continue to appear on the instrument boards of automobiles but it seems to me the engineers do little to ease some of the real annoyances that motorists suffer. For example, take the matter of jacks. When a tire goes flat, the driver still has to get out and do an overalls job to jack up his car. Why can't jacks be built into the car and so designed that they operate through a gear mechanism powered by the motor? Then the motorist could raise or lower his car by merely pressing a button or throwing a lever. Such innovations would be of practical value to the driver—much more so, I think, than trick cigarette lighters and similar gadgets.—A.F.T., Detroit, Mich.

Don't Overlook the Tools, Says This Reader

NUMEROUS interesting suggestions that have proved invaluable in my workshop have come to me through your magazine. Now I have a suggestion to make. Many men could do better and neater work, I believe, if you would run a series of articles describing the proper use and care of different tools. Most home-workshop enthusiasts do not know the kind of work each type is specially designed for. Also, tell the amateur how to sharpen his tools.—W.J.Q., Glendale, Calif.

A Case of Two Negatives Causing a Rift in Clouds

LOOKING back over some old issues I came across a letter from B.H., of Blanchester, Ohio, telling how he had noted that low-flying clouds split and separated when approaching and moving over the tall antenna tower of a radio station visible from his home. I reason the cause for this as follows: Rain might be considered as a colloidal state of a liquid (water) in a gas (air). Colloids are minute particles of matter that do not form a true solution but are suspended by the pressure of the matter which envelops them. These particles carry charges of negative electricity. During a thunder storm, a tall steel framework becomes charged negatively, or like the "colloidal" water. As like charges repel each other, the clouds would be repelled from the antenna tower.—F.S.H., Jerseyville, Ill.

She Would Bake A Good Batch of Pottery

IN LINE of suggesting articles for your magazine, I would appreciate an article telling how to construct a small and inexpensive electric pottery kiln. I have a small one-dollar baking oven made of sheet metal. It would be helpful and convenient for me if I knew some simple way to insulate and equip this for electric heating. No doubt many other readers are interested in pottery making and would benefit by such an article.—(Mrs.) V.H., Chicago, Ill.

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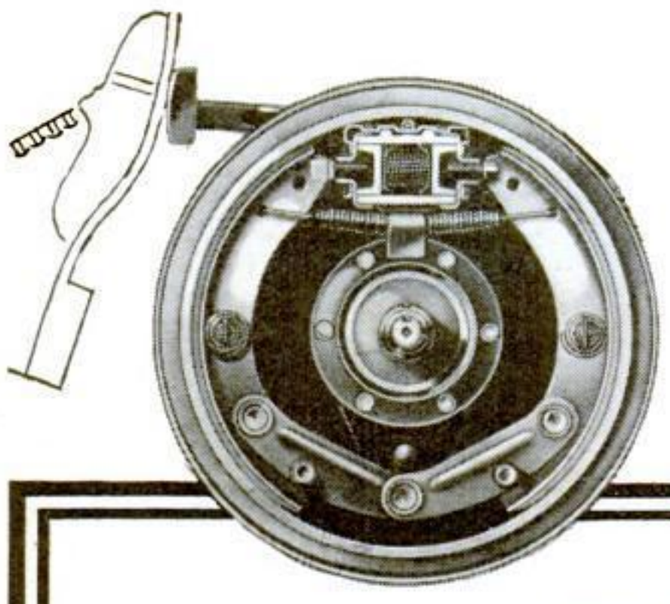

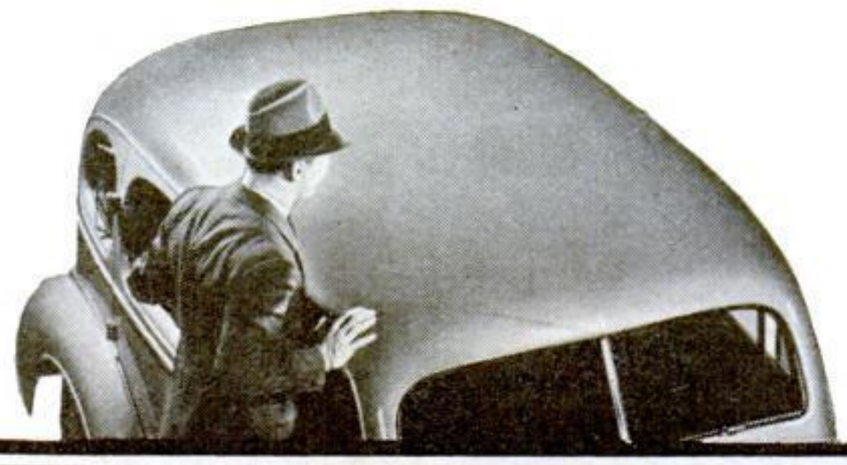

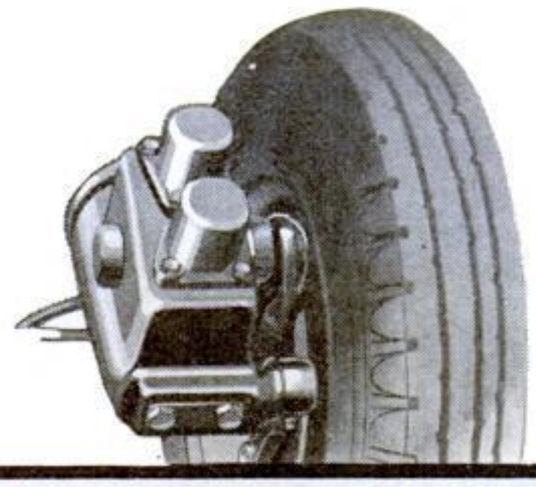

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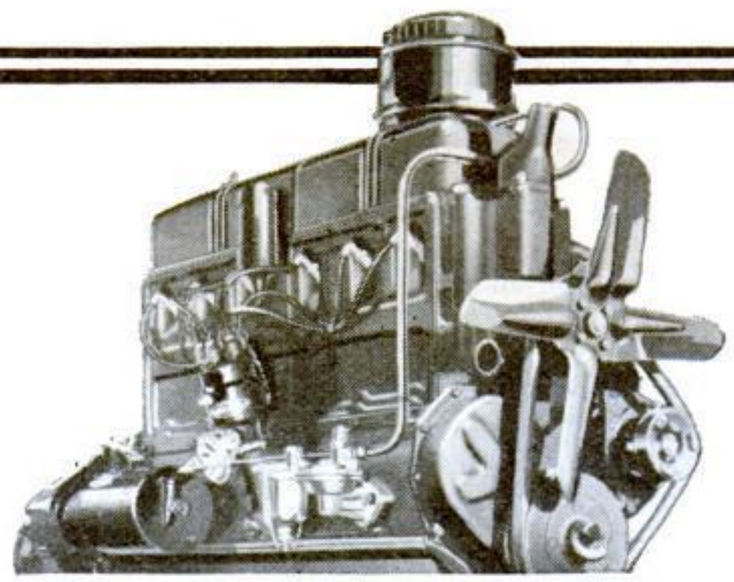
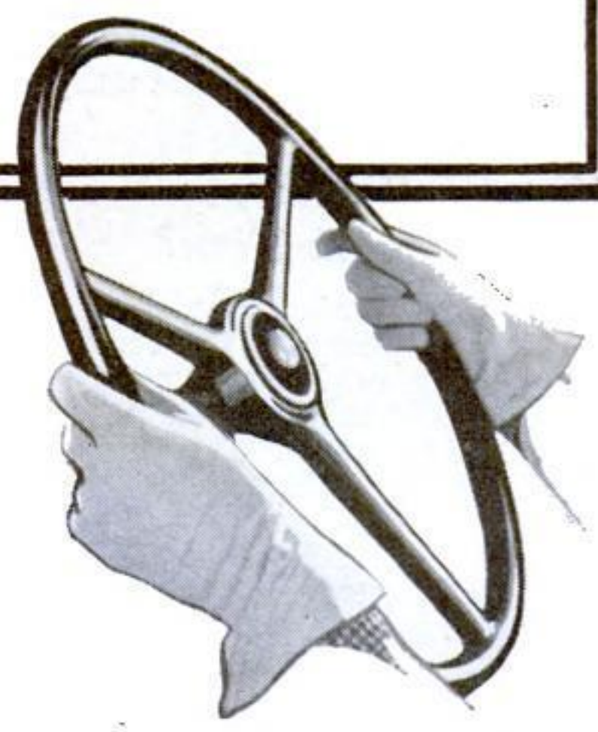


HIGH-COMPRESSION VALVE-IN-HEAD ENGINE
Most economical of all multi-cylinder power plants



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Making driving easier and safer by eliminating steering wheel vibration

AMERICA is giving overwhelming preference to the 1936 Chevrolet because it's the *only* car in its price range with all the following features which mean so much to motoring enjoyment.

It's the only low-priced car with New Perfected Hydraulic Brakes, which impartial authorities agree will stop a car most quickly, smoothly and safely . . .

The only low-priced car with a Solid Steel one-piece Turret Top—the *strongest* and *safest* top built, and the style-mark of a modern car . . .

The only low-priced car with the famous Knee-Action Gliding Ride*, Genuine Fisher No Draft Ventilation, and Shockproof Steering*—all of which are essential to maximum motoring comfort . . .

And the only low-priced car with a High-Compression Valve-in-Head Engine of the same powerful, dependable type which is used in record-holding airplanes, power boats and racing cars.

Only a motor car with all these features can be called "complete"; only the new 1936 Chevrolet brings you all these features at low prices; and that is why people call it *the only complete low-priced car.*

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

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GENUINE FISHER NO DRAFT VENTILATION • • HIGH-COMPRESSION VALVE-IN-HEAD ENGINE • • SHOCKPROOF STEERING*
GENERAL MOTORS INSTALLMENT PLAN—MONTHLY PAYMENTS TO SUIT YOUR PURSE. **Available in Master De Luxe models only. Knee-Action, $20 additional.*

A GENERAL MOTORS VALUE

The only complete CHEVROLET *low-priced car*

FOR ECONOMICAL TRANSPORTATION

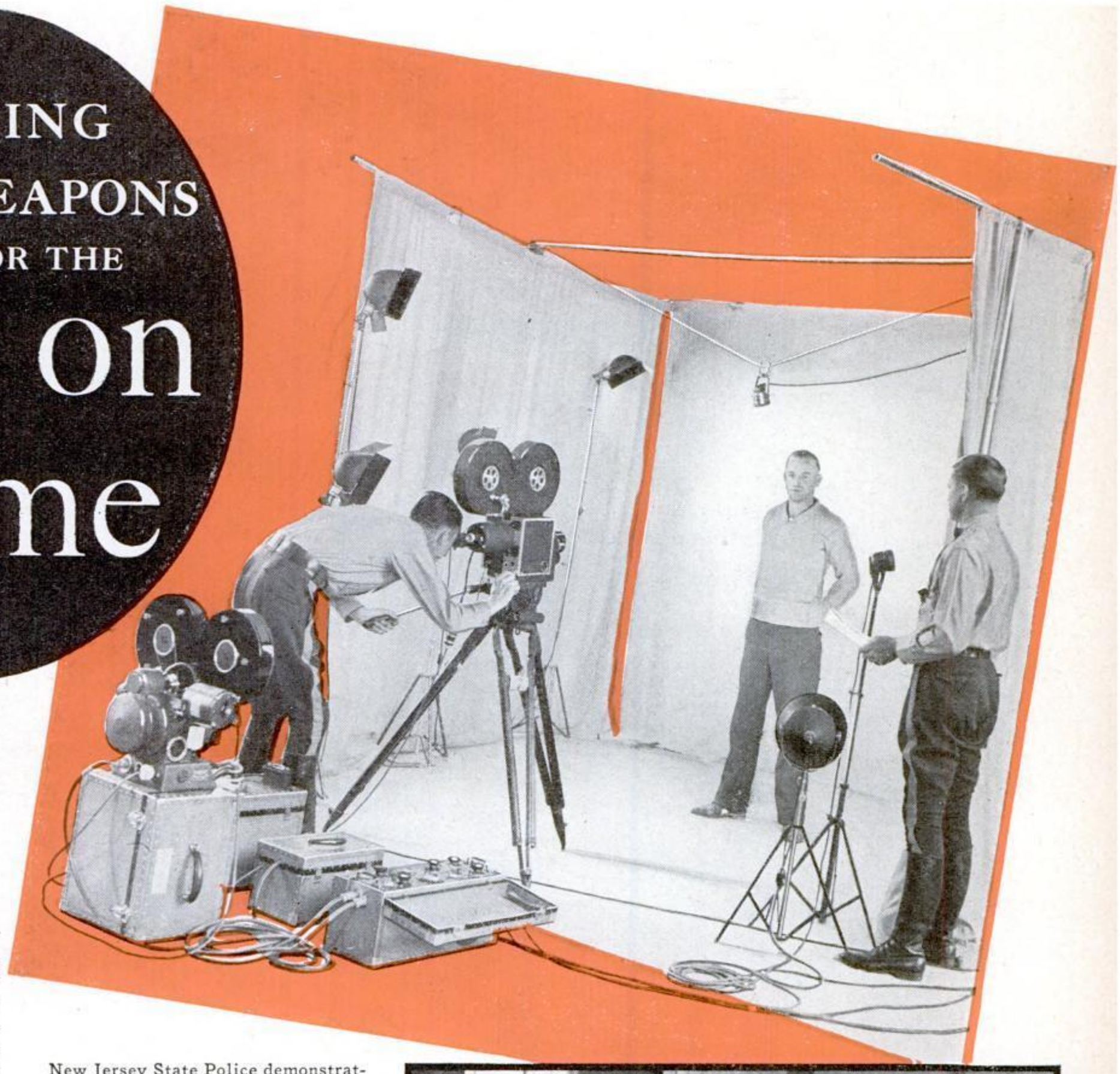
POPULAR SCIENCE Monthly

AUGUST 1936 VOL. 129 No. 2

RAYMOND J. BROWN, Editor

FORGING NEW WEAPONS FOR THE War on Crime

By EDWIN TEALE



IN A darkened auditorium at Trenton, N. J., a few days ago, nearly 500 police officials sat fascinated by a new kind of talking picture, an animated rogues' gallery which soon may rank with fingerprinting as a scientific aid to identification.

New Jersey State Police demonstrating the use of equipment for making talking motion pictures of criminals as an aid to identification by voice and mannerisms. At the right is shown the simple sound-recording apparatus

Produced under the direction of Col. H. Norman Schwarzkopf, for many years Superintendent of New Jersey State Police, the experimental reels replace conventional "wanted" circulars with 300-foot sound movies. They show the criminal walking, talking, lighting a cigarette, going through a standard routine which reveals to watching detectives vital information about the gait, expression, and mannerisms of the hunted man.

J. Edgar Hoover, Director of the Federal Bureau of Investigation, has become interested in the idea and further tests are under way in the scientific crime-detection laboratories at Washington, D. C. Eventually, it is hoped, an archives of master negatives will be established just as files of the fingerprints of notorious criminals are maintained at present.

Behind this innovation, which has brought Hollywood technique to the crime laboratory, lies more than a year of research and testing. Special apparatus, designed in collaboration with engineers of the Radio Corporation of America, makes it

POLICE MEET GANGLAND'S CHALLENGE WITH SCIENTIFIC METHODS AND INVENTIONS

The Nassau County, N. Y., Police Department's crime laboratory on wheels, a trailer equipped with record files, fingerprinting apparatus, and other aids to modern crime detection

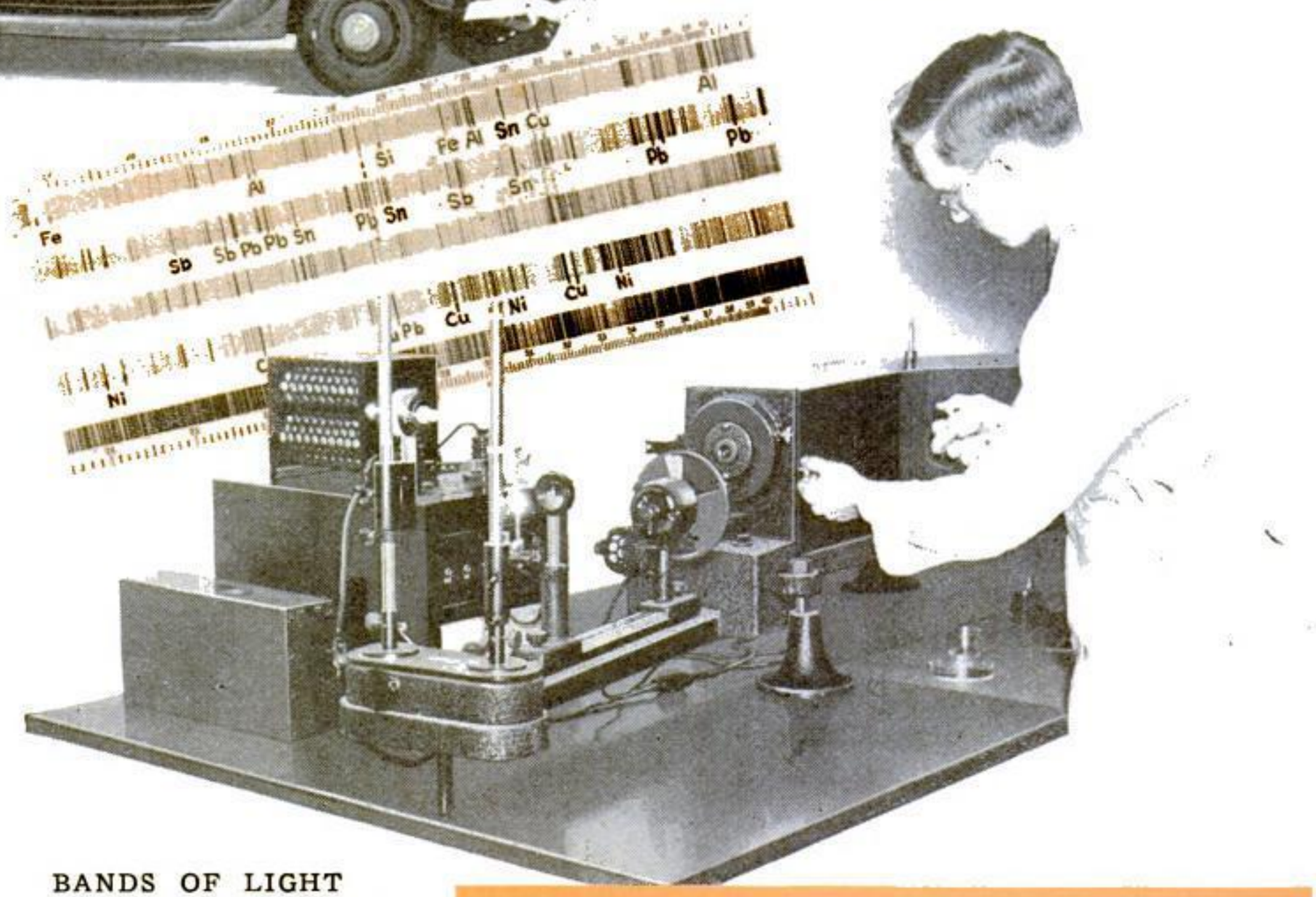
possible for an inexperienced police officer to turn out perfect sound reels. The whole equipment, including a movie camera with three lenses, a portable sound-recording apparatus, six floodlights, two spotlights, microphones, and a collapsible studio of iron rods and gray curtains, can be packed into a half dozen suit cases and carried in a small car.

In the event of a nation-wide man hunt, such talkies of a criminal could be distributed to theaters as well as to police stations. Thus, in a short time, millions of people would be put on the alert, watching for the wanted man. Catching crooks with real-life "crook films" promises a radical advance in criminology.

And it is but one of many new developments in police technique. In all parts of the country, science is forging new weapons for its endless war on crime.

For example, an inventor in Rochester, N. Y., has obtained a patent on a scientific "prison of the future," a riotproof, escapeproof structure with hanging corridors, hidden microphones, and a vast network of pipes that can flood the cells with tear gas in the event of a riot.

Suspended from the ceiling of the prison, the long tubelike corridors will run between the rows of cells. "One-way" windows will permit guards to watch desperate criminals without being seen. At the flip of a switch, floodlights, which are housed in bulletproof glass, will illuminate the interior. Doors are so designed that they act as shields against bullets when they are swung partially open to permit guards to toss in tear-gas bombs.



BANDS OF LIGHT SHOW HIDDEN METALS

A spectrograph used to detect the presence of metals, and some spectra made with it

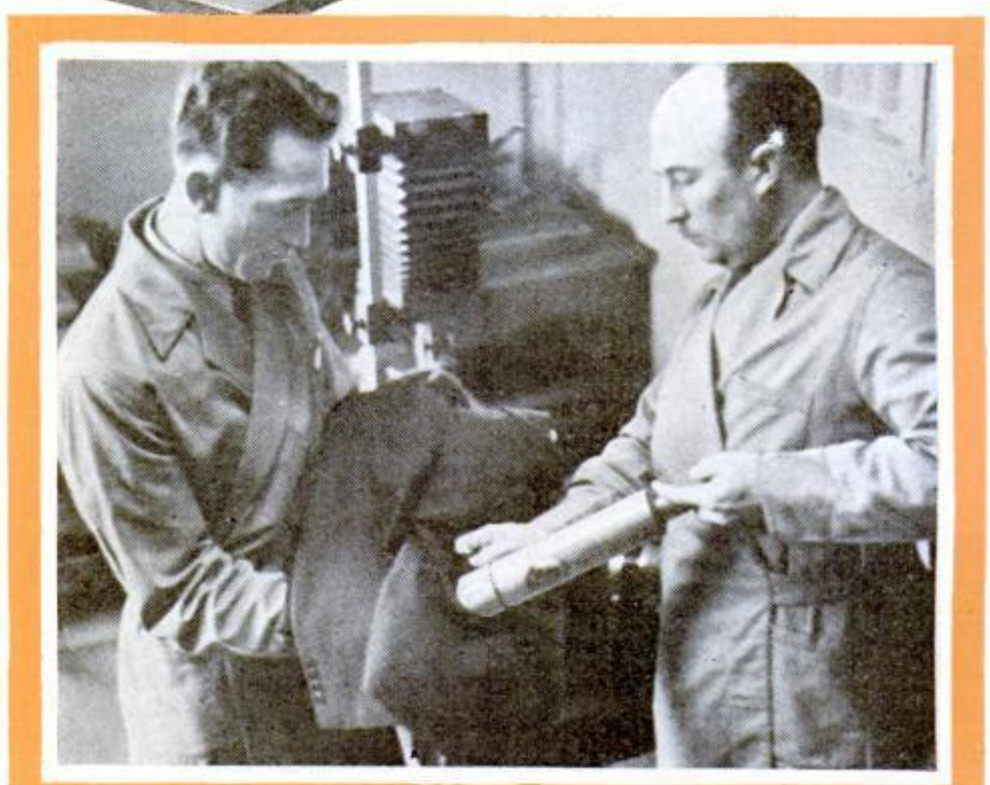
Set in the walls of each corridor, a battery of curious, movable steel balls with holes through the centers will enable the guards to shoot through with either rifles or revolvers. Even if the entire prison is flooded with tear gas in the event of a major riot, the corridors will be free from fumes, as they have their own ventilating systems. R. L. Clark, designer of the scientific prison, declares it will go far toward keeping criminals locked up once they are caught.

With the same end in view, officials at the Westchester County Penitentiary at Eastview, N. Y., have rigged up an ingenious "electric ear" to help guards on the night shift. After eight months trial, it has been adopted as part of the regular equipment.

A combination of radio amplifiers, a microphone, a loudspeaker, and a set of controls forms the "ear." The sensitive microphone is placed in the main corridor of the prison, through which an escape would have to be made. Set to react to any noise louder than ordinary conversation, the apparatus sounds an alarm buzzer in the relief guard's room at the first sign of commotion. Should prisoners overpower and gag the guard on duty, he can set the alarm off by falling over a solid object or "accidentally" tipping over a chair.

A pair of new and unusual aids to crime detection use light rays. Not long ago two elaborate pieces of scientific apparatus, a spectrograph and a spectrophotometer, took their places in the Bureau of Investigation laboratory at Washington. They will help the scientific G-men find and measure microscopic clews in the form of metals, earths, and paints.

By means of lenses, a narrow slit, and a prism, the spectrograph breaks up a beam of light into its constituent colors and re-



New York City police technicians using a new vacuum-cleaner apparatus to remove dust from a suspect's pockets for examination

cords them as narrow bands on a photographic plate. Each band represents a definite wave length of light. As the different elements of the earth, and especially the metals, give off different wave lengths of light when heated, the spectrograph affords a quick and accurate method of analyzing unknown substances. Astronomers use it to determine the elements on distant stars. Because the Bureau of Investigation instruments are equipped with quartz lenses and prisms, they record ultraviolet light which would not pass through ordinary lenses.

To understand how valuable such an aid may prove, imagine yourself watching one of the scientific sleuths at work in the laboratory.

HE IS bending over a copper screen containing a small round hole. Did a bullet make the hole? Upon the answer to that question hangs an important clew in a murder mystery. Carefully the expert clips a bit of screen from the edge of the hole and fixes it in the hollowed-out end of a crayonlike stick of pure graphite. Adjusting a second similar crayon so that an electric arc will be formed between the two, he switches on the current. The metal is heated to vapor and vertical lines on the spectrograph plate record the materials in it. Both copper and lead are present. Without doubt it was a lead object that made the hole. But was it the fatal bullet?

The spectrograph gives final proof. When a fragment of the surface of the bullet taken from the body of the victim vaporizes, the lead lines on the plate show the identical impurities found in the similar metal adhering to the screen. And, more than that, they show strong traces of copper—bits of the screen carried away by the bullet. This clinches the testimony of the spectrograph. Vital information has been obtained in the space of a few minutes.

The speed as well as the extreme sensitiveness of the spectrograph makes it an ideal instrument for the criminologist. Any metallic element can be determined almost instantly even when it is present in quantities as small as a thousandth of one percent.

Take another dramatic use for the new equipment. On the shoes of a suspect are found traces of paint of exactly the same color as that in the room where a woman was murdered. It is damaging evidence. Samples of paint from the room and specks from the shoes are turned over to the laboratory detective. Vaporized in the spectrograph, they leave their lines on the photographic plate. A glance at the record, and the expert knows one paint has a titanium base, the other a zinc base. The paint on the shoes could not have come from the scene of the crime; the spectrograph may save the life of an innocent man.

The spectrophotometer, another amazing helper of the scientific detective, picks out differences in color invisible to human eyes. Cases which involve matching bits of fabric, solids, or minute amounts of liquids may be solved by its use. By identifying human blood and body fluids, it plays its part in clearing up murder mysteries. By means of this pair of "light traps," the spectrograph and the spectrophotometer, criminologists expect to catch the most cunning of outlaws.

TO BRING a crime-detection laboratory right to the scene of a murder as soon as the report comes in, officials of the Nassau County Police Department, on Long Island, N. Y., recently introduced a fully equipped trailer which can be hooked to a patrol car and rushed from headquarters at an instant's notice.

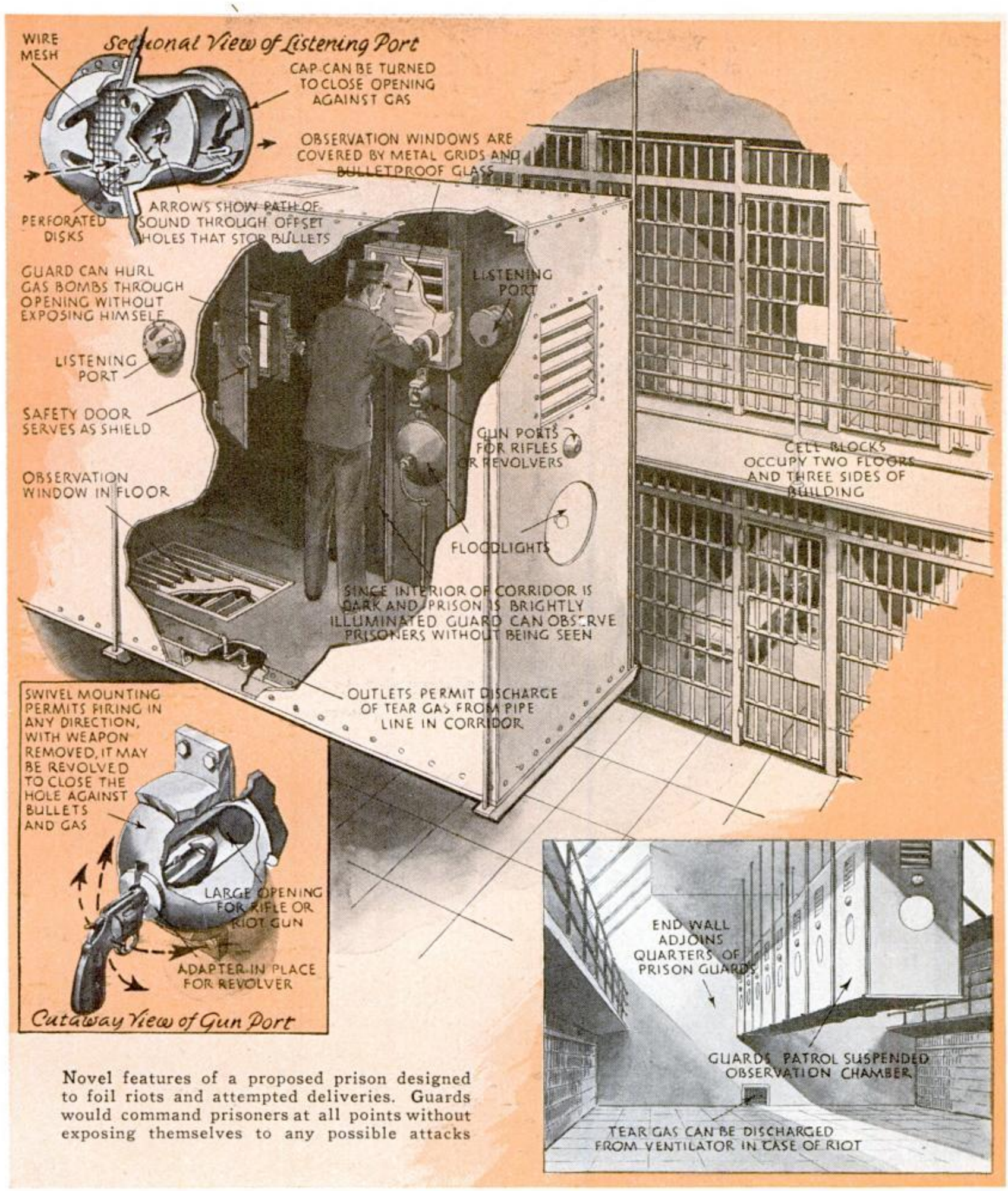
This mobile laboratory carries short-wave radio, a plug-in telephone, finger-print files, photographic equipment, and a wide variety of scientific aids to crime detection. Fifteen and a half feet long, seven feet wide, and six feet high, it can travel at top speed along any highway.

Another advance, recently announced, promises to clip precious hours from the time required to take up the trail of a criminal. The other day, the Federal Communications Commission, in Washington, D. C., announced a shift in its allocation of radio wave bands. This will make possible a nation-wide network of police broadcasting stations using short-wave frequencies to send messages in code.

For nearly a year, the one-kilowatt station WWV, at Beltsville, Md., has been making trial broadcasts under the direction of the Bureau of Standards and the Department of Justice to determine what the reception of police messages would be on different wave bands. Five times a day, four days a week, the experimental broadcasts have gone on the air.

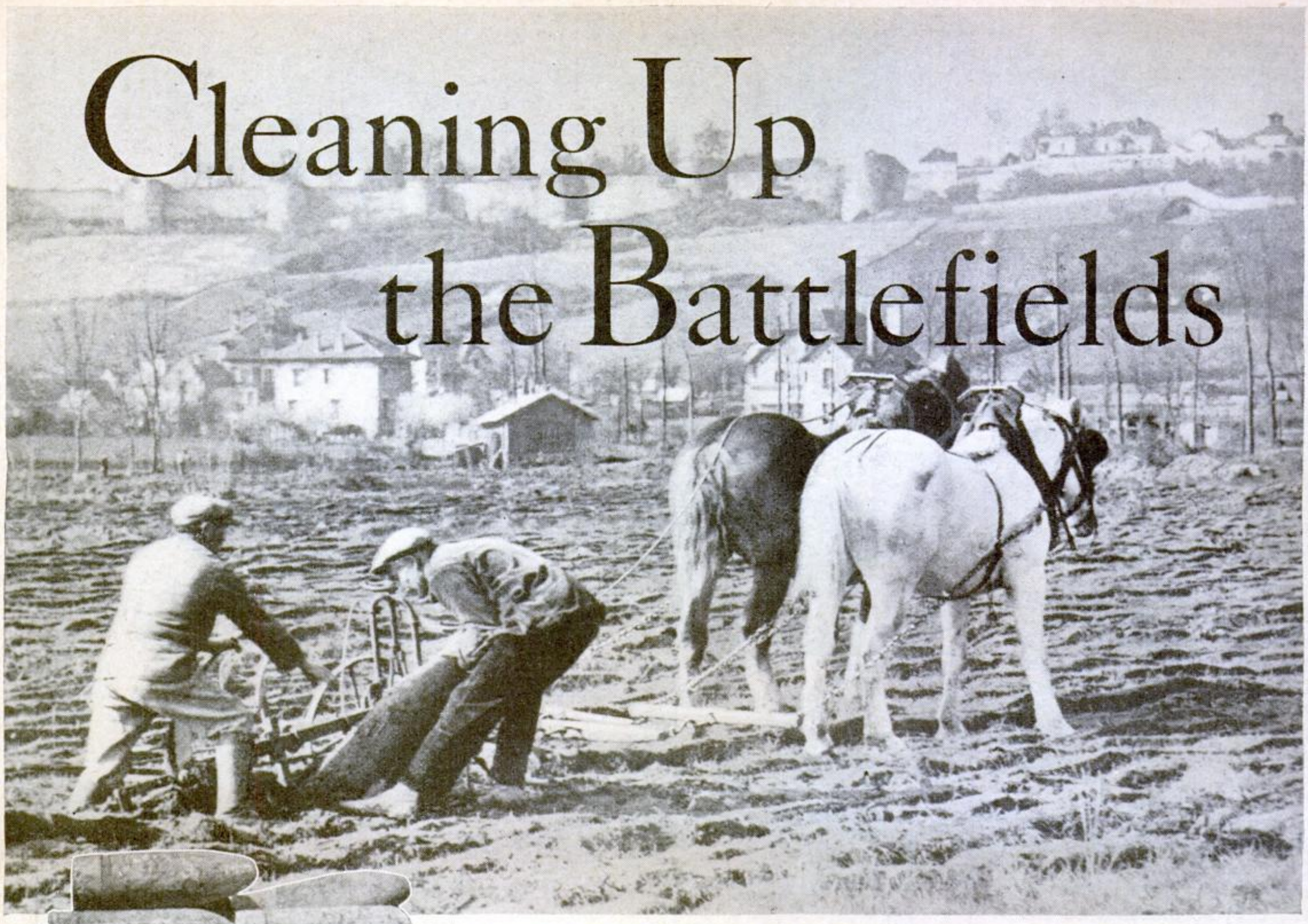
In addition, several cities in the Middle West, including Indianapolis, Ind., St. Louis, Mo., Kansas City, Mo., and Minneapolis, Minn., have carried on extensive tests with intercity radio flashes. A special code, combining letters and numbers, is employed in the work. It is used in teletype and telegraph communications as well as over the air. At frequent intervals the code is changed.

Imagine this *(Continued on page 107)*



Novel features of a proposed prison designed to foil riots and attempted deliveries. Guards would command prisoners at all points without exposing themselves to any possible attacks

Cleaning Up the Battlefields



Workmen removing an unexploded shell from a field beneath the old walls of Coucy-le-Chateau, France. A unique private corporation has a concession for salvaging shells in the battle zones, where many farmers have been killed by duds. Below, a pile of recovered German 77's

IT WAS night on the old battlefield. Eerie shapes loomed—jagged, ruined walls; tortured, stunted trees; webs of barbed wire; blasted earth upheaved from craterlike shell holes. In one hole a fire burned, spreading its ruddy glow over a scene that was weird indeed.

In the background brooded the dim bulk of the famous Ossuary of Verdun, the grand, pathetic sanctuary of the bones of thousands of unidentified soldiers found upon the most famous battlefield in the world. Toward the ossuary paced gnomelike figures, bent beneath burdens. They moved partly in shadow, partly illumined by the outer circle of firelight.

Near-by, their shapes thrown into relief by the flames, stood another group. They were young men, their faces sad and earnest as they chanted hymns of peace for the whole world. Leading them was a venerable figure in clerical garb. Higher rose the singing, hotter burned the fire.

Suddenly, its light was eclipsed by a blinding glare that seemed to spring from the earth. The air quivered, choked with thick smoke, hummed with flying metal fragments. With cries of pain, figures fell to the ground—among them that of the priest. The good Abbe Delle was dead, rescuers found, and eleven were wounded among the French youths whom he had brought, each year since the Armistice, from Lille to Verdun to search out and honor the remains of the dead, French or German, still hidden on the battlefield.

Up through the sod of that field had thrust the fingers of an old battle that had claimed nearly a million lives, to snatch yet more—eighteen years afterward, from good people praying that battles might end. Those dead fingers had fanned the fire to explode an old shell that had lain all those years in its lair beneath the earth, like a serpent that is never surely harmless until it has been deprived of its venomous fangs.

That recent dramatic episode shocked the people of France and Belgium to a realization that not all these years had served to root out the menace of the "red zone," the old battlefields of the World War. Six hundred miles long, twenty to fifty miles or more wide, it stretches from the North Sea to Switzerland and contains nearly 10,000,000 acres. At a touch of the peaceful plow, of children playing, or of tourists hunting souvenirs, the coiled serpents strike—the old shells that did not explode, but burrowed into the earth.

Today, after eighteen years, there are probably still millions of those unexploded shells lying beneath the earth's surface on the former Western Front alone, and more millions on the other old fronts. And, every now and then, one goes off. Within two weeks, last year, there occurred two explosions that killed

Unexploded Shells, Buried in the Soil Of France Since the World War, Afford A Grisly Harvest for an Odd Industry

By THOMAS M. JOHNSON

thirteen children and sent twenty-two to hospitals—they were playing with duds.

In this country, war souvenirs brought back by veterans are still exploding, despite police warnings. Because a shell is old, it is not harmless. Only recently, a man was killed by an old shell while plowing a Civil War battlefield in Georgia. In a hotel cellar in Paris, for the sixty-five years since the Franco-Prussian War, they had used a dud to crush coal. Some one tried to mend its crude handle with a red-hot poker. They had to rebuild the hotel. In one year after the World War, the Paris municipal laboratory destroyed a thousand such deadly souvenirs, picked up in the streets.

Lying in plain sight, at least these gave warning, like the relatively sportsmanlike rattlesnake. In the "red zone" they strike by stealth.

Christophe Parentin came happily back to his forest in Lorraine. A woodchopper, he had served four years in filthy trenches, longing for the clean woods and the grip of his ax. Now, the war over, he surveyed a forest riven by bullet and shell, trees splintered and scorched.

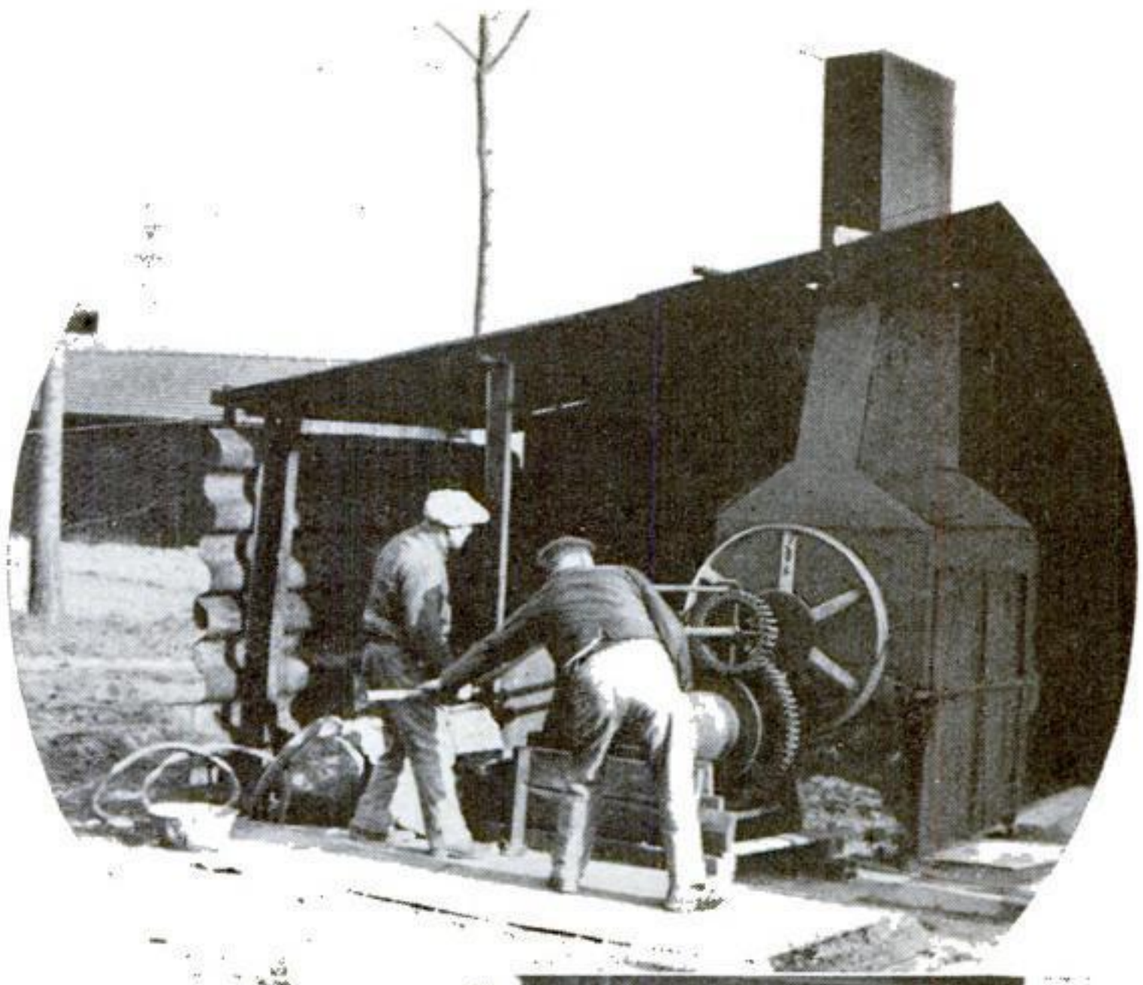
"Let us clean up this war mess," said Christophe.

He swung his ax against a dead tree. A flash, a crash, and Christophe was hurled fifty feet. The ax had struck a dud, embedded in the tree-trunk.

Not far away, in Alsace, on the famous Hartmansweilerkopf, a forest fire began. Then came the roar of an explosion—another, and another. The fire was setting off the dud shells. The fire fighters had to let it burn over 500 acres of valuable woodland. That was in the year 1929.

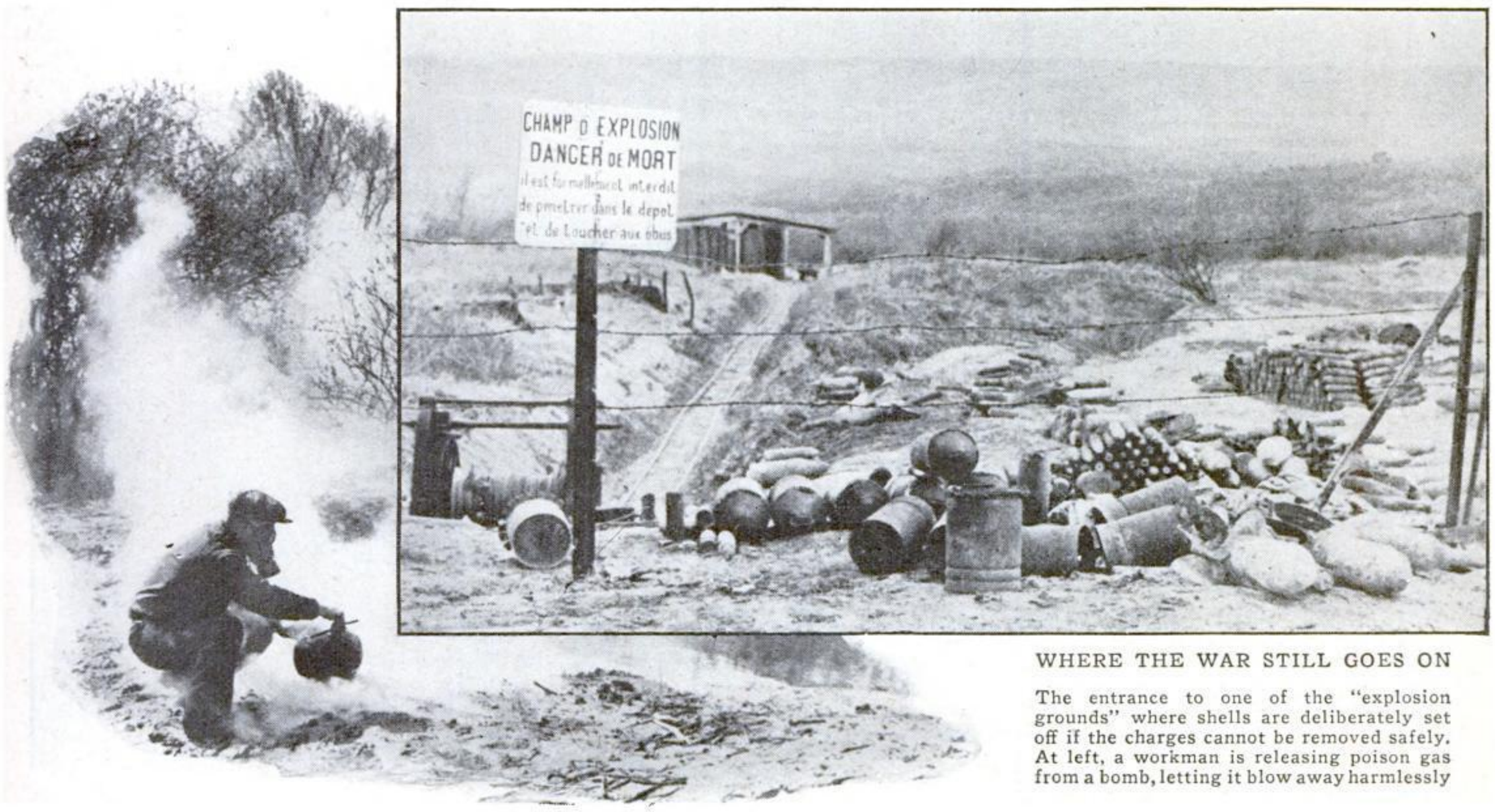
To win against such perils, has taken a new race of brave pioneers. To reconquer the "red zone" for peace, they have called in the science of explosives, and to it have added new methods. Monkeying with a dud is about as dangerous as any work there is. The probing fingers continuously prod death—sudden, violent. The fighters in the guerrilla war for peace have many hazardous adventures in their unique campaign.

Their problem after the Armistice staggers imagination. In those 10,000,000 acres, including twelve percent of all France, and its most highly developed industrial area, 9,000 factories were razed or crippled. So were 200 coal shafts, thirty-four iron mines, 1,500 miles of railway, 6,000 bridges, and 4,068 towns. These last included many like the twenty hamlets beaten into the earth of the great American Meuse-Argonne battlefield, and now marked by signs like: "This was the village of Flirey." *(Continued on page 102)*



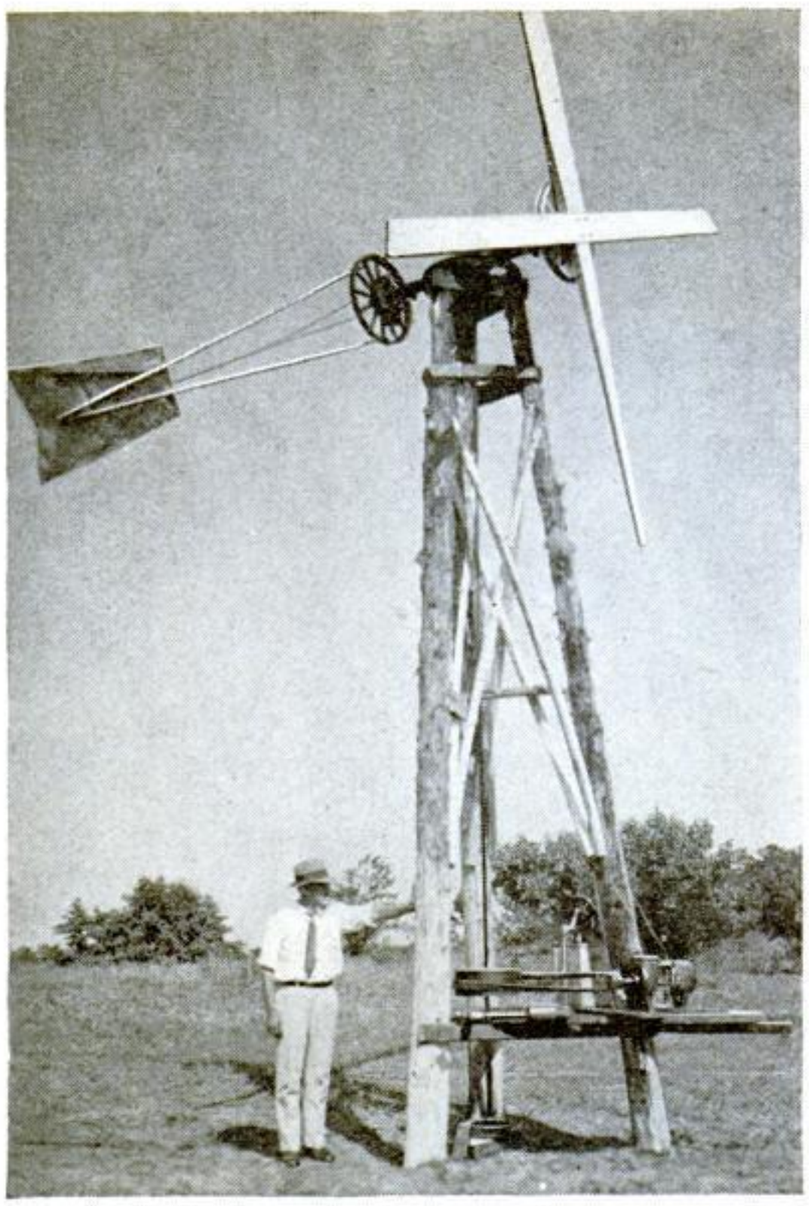
An oven in which small-arms ammunition is roasted, after the powder has been removed from the shells, to explode caps

By turning this wheel, a workman unscrews the fuse from a shell on the other side of a wall which guards him from possible blasts



WHERE THE WAR STILL GOES ON

The entrance to one of the "explosion grounds" where shells are deliberately set off if the charges cannot be removed safely. At left, a workman is releasing poison gas from a bomb, letting it blow away harmlessly

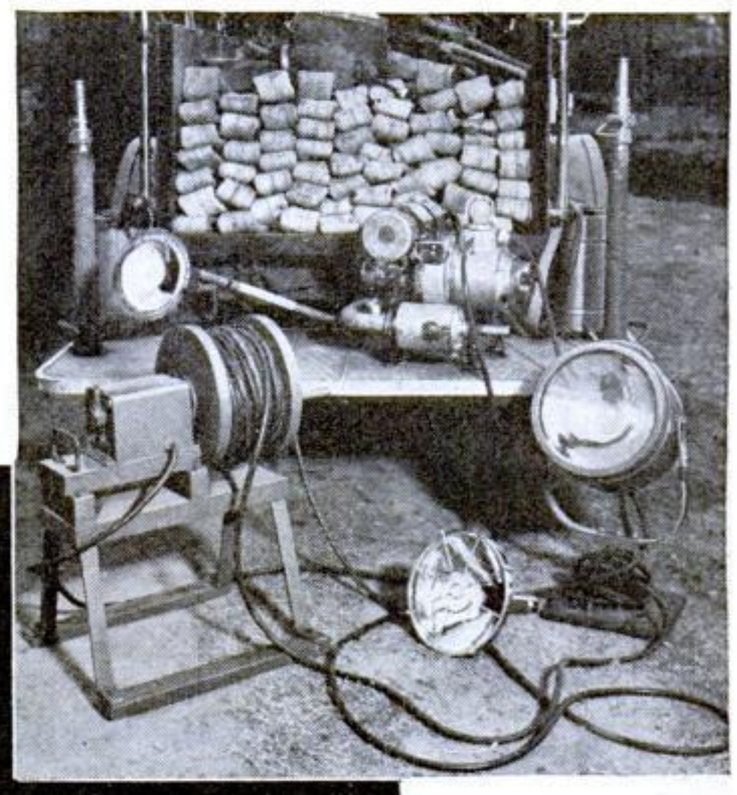


MAKES WINDMILL GENERATOR WITH CAST-OFF AUTO PARTS

A NOVEL homemade windmill generator that cost less than three dollars utilizes the rear end and differential gears salvaged from an old auto. Twelve-foot blades are fastened to one of the car wheels, and the assembly is mounted on a rotating support on top of an improvised tower. A rudder projecting from the second wheel keeps the blades facing into the wind, while an eighteen-foot shaft connected into the differential drives a small generator.

FLOODLIGHTS SEARCH LAKE BOTTOMS

PORTABLE underwater lighting equipment has recently been developed to aid in searching the bottoms of lakes, ponds, and rivers at night. Powerful floodlamps are mounted in water-tight, highly polished reflectors, and fastened to the ends of long, lightweight poles. Current is supplied by a portable gasoline-driven generator on the floor of the search boat, from which operators lower the lights to within eighteen inches of the bottom. When flooded with light from one of these brilliant diving lamps, the lake or river bed can be clearly seen from the surface in depths up to twenty feet, it is said. In cases where the water is muddy, it is first cleared with special chemicals. The lights are expected to be of special value in lake or resort communities, where they may be kept available by police or fire departments.



Portable underwater lighting equipment, including generator and cable, loaded on a fire truck for use in an emergency

Searchers exploring a lake bottom from a rowboat. The gasoline-driven generator in the boat supplies the current

Tubes of chemicals, color chart, and an electric heater used in carbon monoxide test. Right, workmen using safety lamp

DETECTS CARBON MONOXIDE GAS IN MANHOLES

BEFORE DESCENDING into street manholes to repair underground cables, telephone workmen now use a carbon monoxide detector to reveal the presence of dangerous amounts of the poisonous, odorless gas. A sealed glass tube, containing a chemical solution, wrapped in cotton, and covered with a transparent envelope, is crushed and suspended in the manhole for ten minutes. If carbon monoxide is present underground, the chemicals will precipitate a black powder on the cotton. When raised to the surface, the shade of black or gray on the cotton is compared with a standard color chart to reveal the amount of gas present. In cold weather, an electric heater is used to hasten the reaction. Safety lamps also are employed.

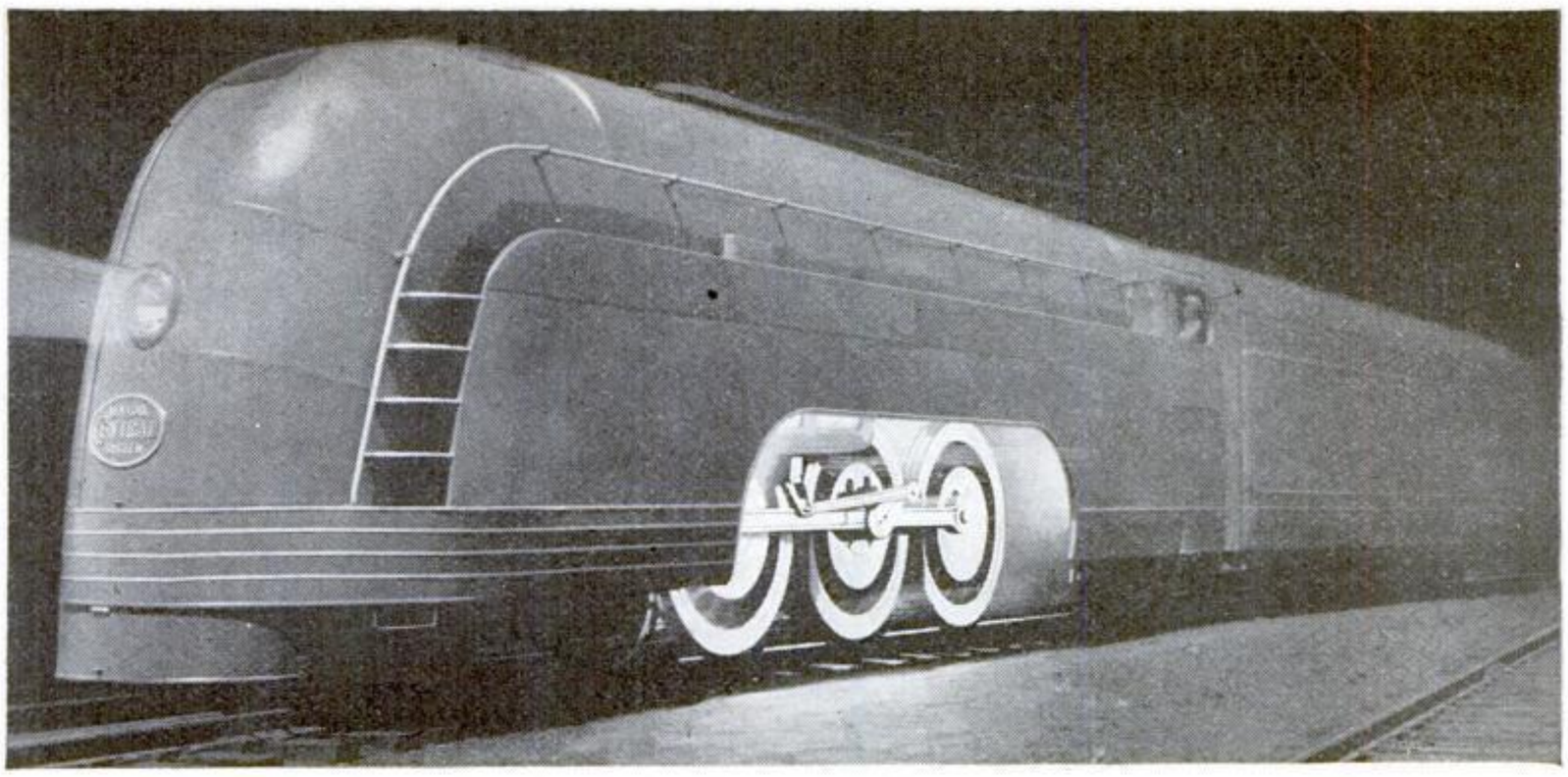
TROLLEY POWERS HAND TOOLS

GREATER efficiency in working with portable electric tools is made possible by an overhead track and trolley system designed for use in shops and manufacturing plants. Shown below installed in the cutting department of a clothing factory, the system provides a continuous outlet contact for tools, thus eliminating long cords that get in the operators' way. The trolley moves freely on a metal track.

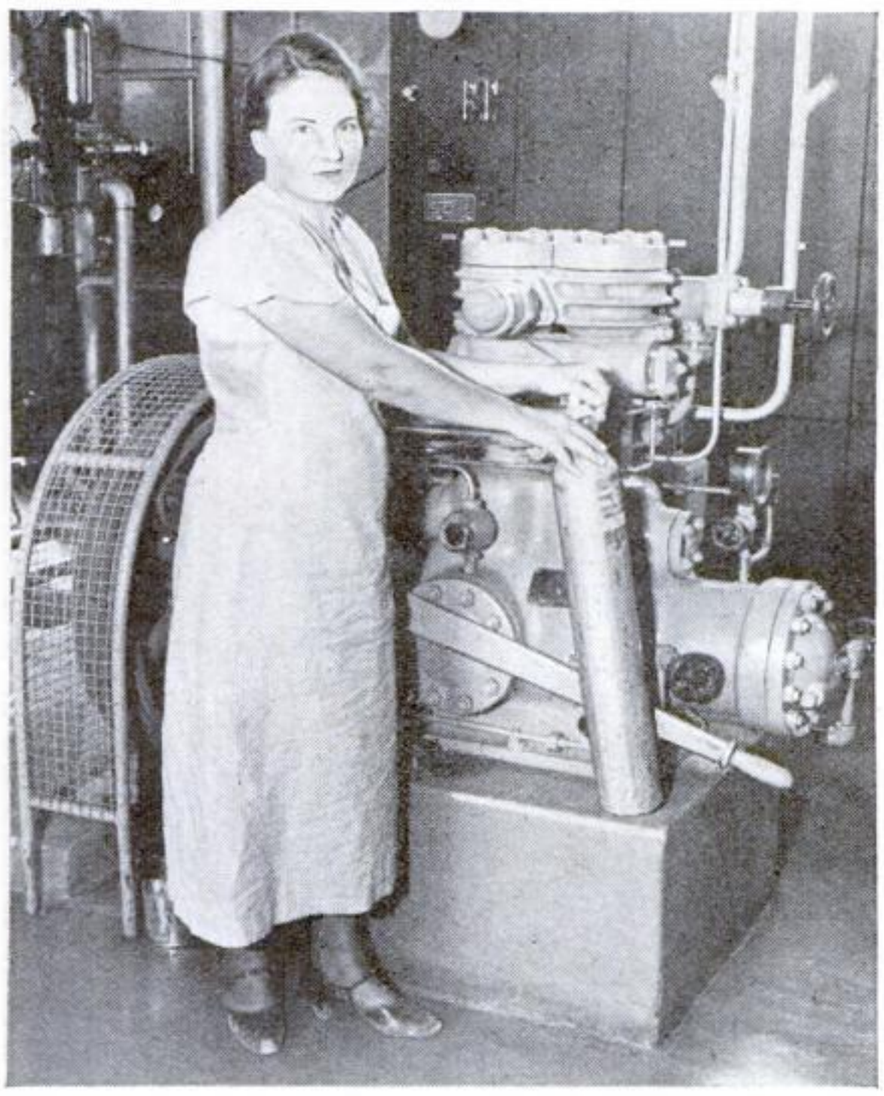
Garment cutters using electric tools with overhead trolley

Streamline Engine Has Illuminated Driving Wheels

HURTLING through the night at a speed of more than a mile a minute, the Mercury, new streamline steam locomotive just completed for the New York Central Lines, will present a weird appearance with its brightly painted, seventy-nine-inch driving wheels illuminated by floodlights concealed under the cowling. Drawing a train of specially designed streamline cars, the Mercury will make the run between Cleveland, Ohio, and Detroit, Mich., at an average speed of sixty miles an hour.



The Mercury, new streamline steam locomotive recently completed for the New York Central Lines



Mrs. Carl M. Einhart with carbon dioxide from desert fumes

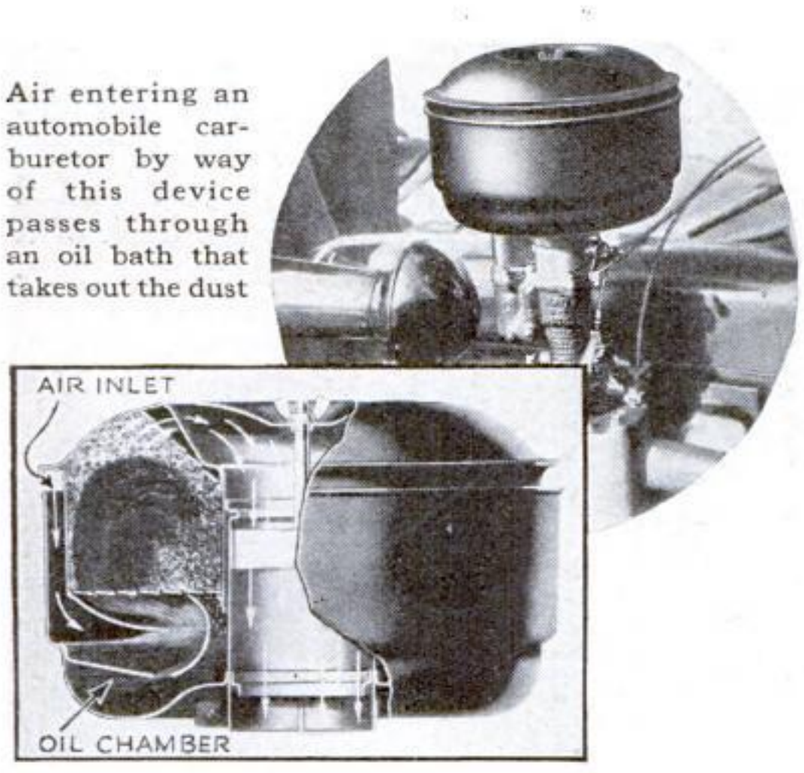
DESERT SMOKE HOLE YIELDS "DRY ICE"

IN ONE of the hottest places in the United States, the sun-baked desert near the Salton Sea in California, an unusual industry is extracting "dry ice" from the fumes of a baby volcano. This odd enterprise owes its birth to the curiosity of Mrs. Carl M. Einhart, shown at the left, whose interest in the characteristic "mud pots," smoking holes in the slate-gray mud of the desert, led her to have the fumes analyzed. The escaping gas was found to be almost pure carbon dioxide, and a plant was set up to capitalize on its commercial value. In addition to converting the gas into "dry ice," the plant bottles it under pressure for use in carbonating beverages and as a material for use in connection with some kinds of fire-fighting equipment.

A simple branding device, shown at the left, makes permanent scars on fruit

GROWERS "BRAND" FRUIT

TO FOIL fruit thieves, avocado growers now "brand" the green fruit with a distinctive marking by means of a small device that is worn on the thumb. The scars remain on the ripened avocado.



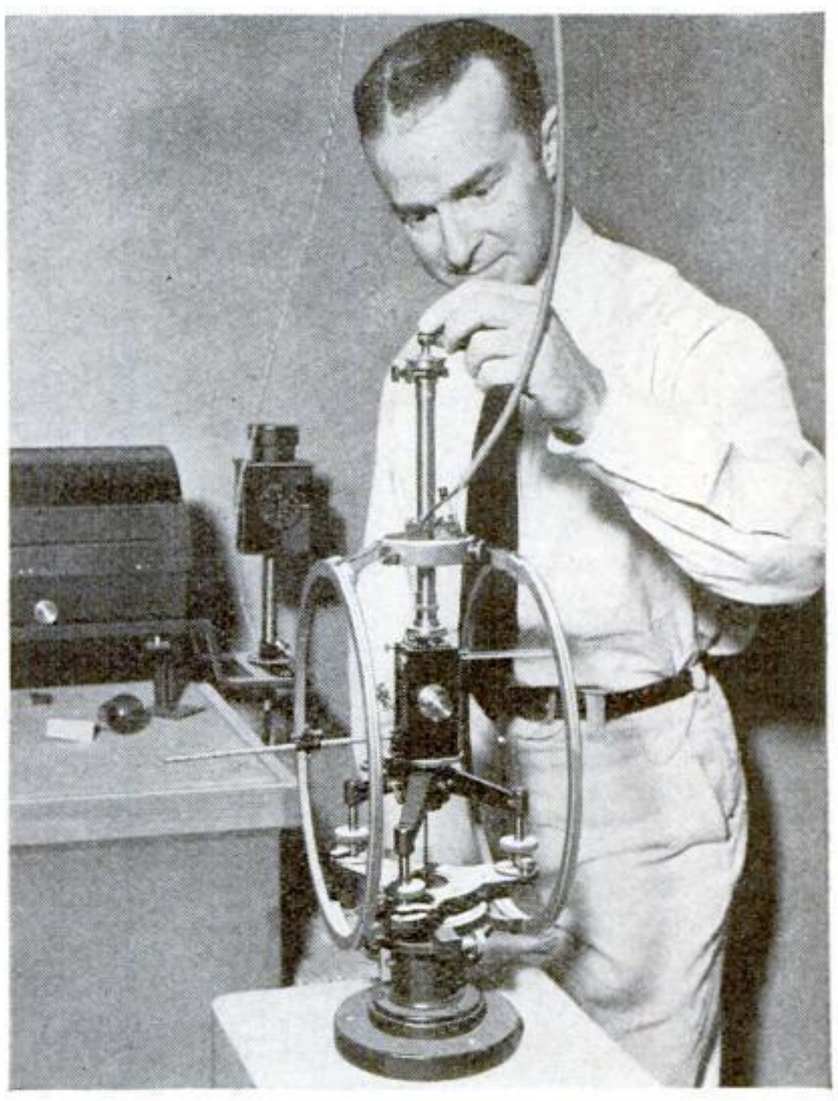
Air entering an automobile carburetor by way of this device passes through an oil bath that takes out the dust

CARBURETOR AIR CLEANER

A NEW oil-bath air cleaner for automobile carburetors is said to be so efficient that it operates perfectly even during a severe dust storm. Air entering the cleaner is led into a dense oil fog or mist, which traps the dust, allowing only clean air to pass along to the carburetor. The oil need be replenished only after a long period of use.

EARTH MAGNETISM IS MEASURED

UNSOLVED mysteries of the earth's interior are being studied with the aid of a tiny instrument known as a "magnetometer," recently installed at an observatory in California. The device contains a bar magnet, suspended on a twisted thread of quartz, which acts like a compass needle and responds to changes in the earth's magnetic field. A beam of light, reflected from a mirror at the tip of the bar, traces its movements upon a piece of photographic paper. Scientists declare that some of the fluctuations in the earth's magnetic behavior, causing the reading of a compass at a given point to change slightly from year to year, reflect titanic changes occurring too far beneath the surface of the earth to be investigated by any other means. Other variations are ascribed to the sun's influence.

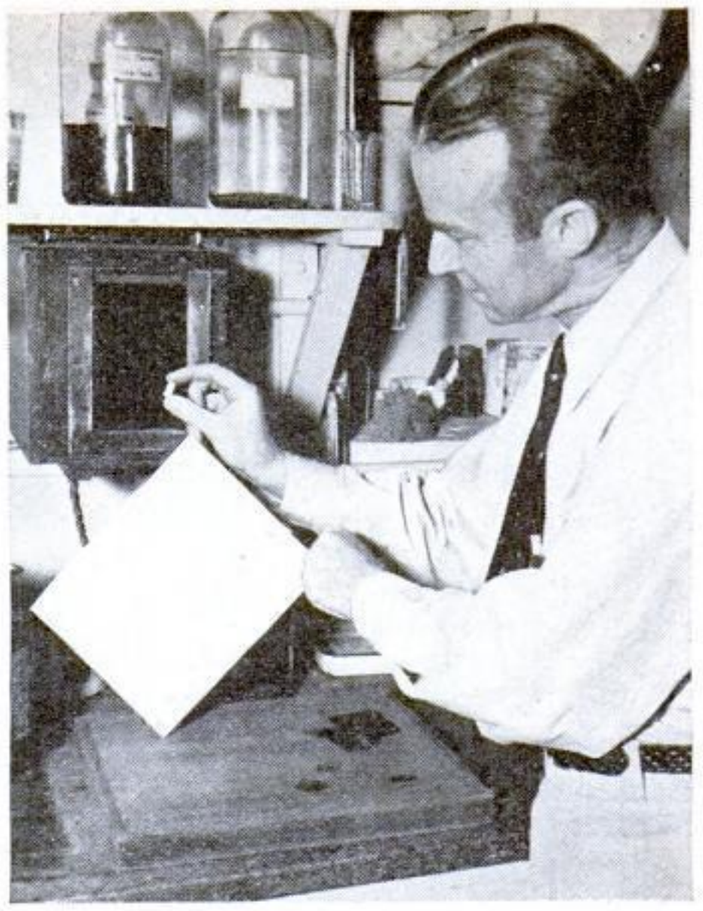


An observer adjusting the magnetometer, an instrument that records variations in the magnetism of the earth

TALKING MIRROR GIVES SALES SPIEL

A sensitive electrical detector starts an automatic phonograph when anyone comes near this mirror. The parts are seen below

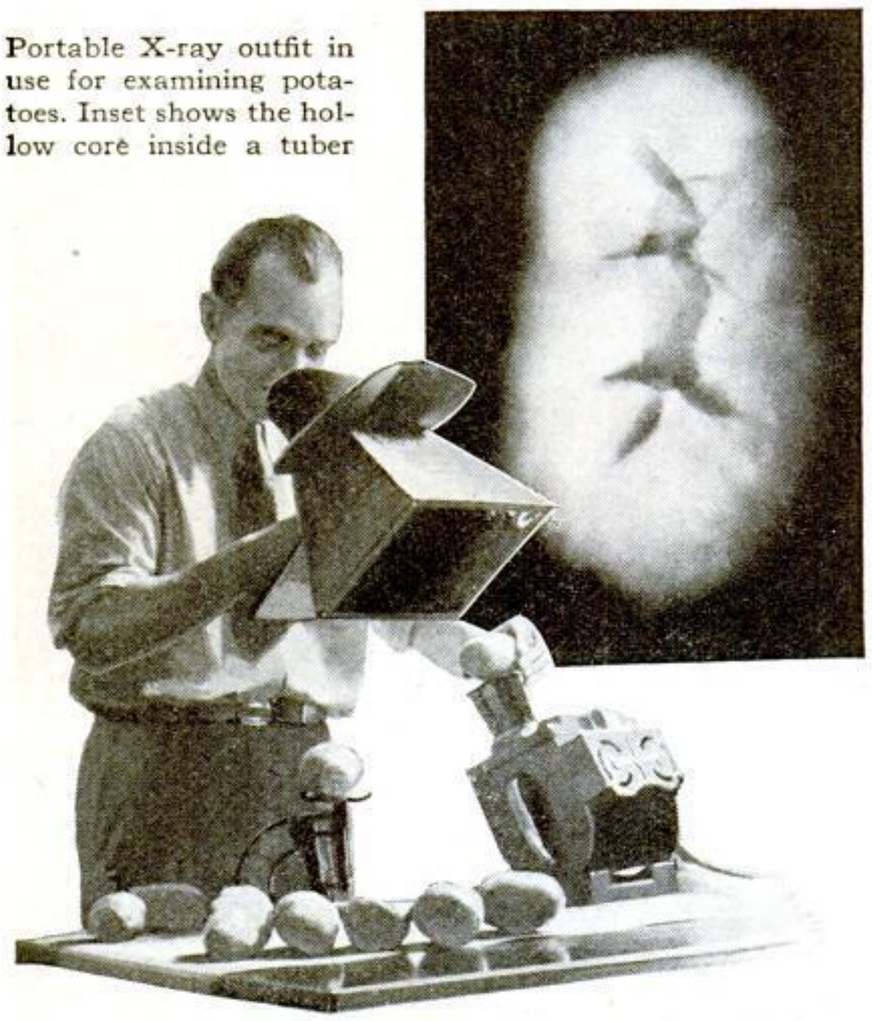
WHEN you approach a mirror of new design to straighten your tie or adjust your hat, a concealed phonograph startles you by launching into a glib advertising talk. The apparatus is actuated by a sensitive detector, in the form of a metal loop, which responds to the changed electrical capacity of the surroundings when you step within range. Counting upon the natural lure of a mirror for men and women alike, the inventor proposes that his machine could be employed in department stores and public waiting rooms to boost the sales of shaving materials, cosmetics, and other products. It may also be used in conjunction with slot machines, and, if desired, a selection of popular songs may be substituted for the advertising message as a novelty feature in places of amusement.



HUGE STARS PICTURED ON TINY PHOTO PLATES

DARKROOM workers of the Mt. Wilson Observatory at Pasadena, Calif., must be careful lest the astronomers' pictorial trophies slip through their fingers—for the smallest of the photographic plates used in recording discoveries in the depths of space measures only one quarter by three quarters of an inch. In the picture above, it is shown compared with an eight by ten-inch plate, also used in photographing far-distant stars. The largest plates used at Mt. Wilson are fourteen by seventeen inches.

Portable X-ray outfit in use for examining potatoes. Inset shows the hollow core inside a tuber

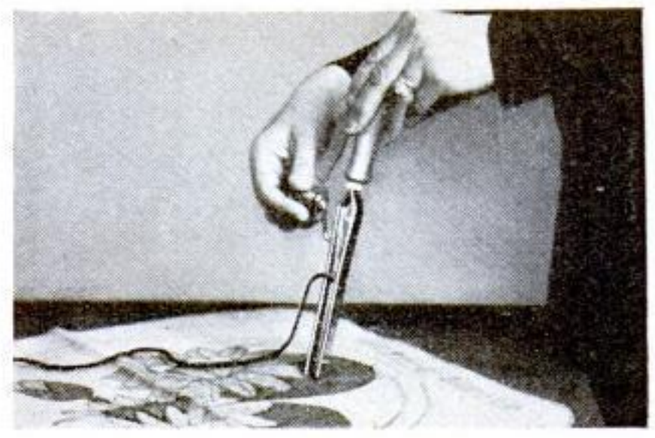


X RAYS SHOW HIDDEN FLAWS IN FRUITS AND VEGETABLES

FRUITS and vegetables may now be inspected before marketing, by a method as simple as the candling of eggs, with the aid of a portable X-ray outfit developed for the purpose at the University of Minnesota. Shadow pictures clearly show whether an apple is rotten at the core, or a potato hollow at the center, when it is placed in the path of the rays and examined with a viewing screen held in the hand. Since the samples need not be cut open for examination, no waste is involved. Scientific investigation of the causes of defects in fruits and vegetables will also be aided by the device, as it may be applied without removing them from the tree or vine on which they grow.

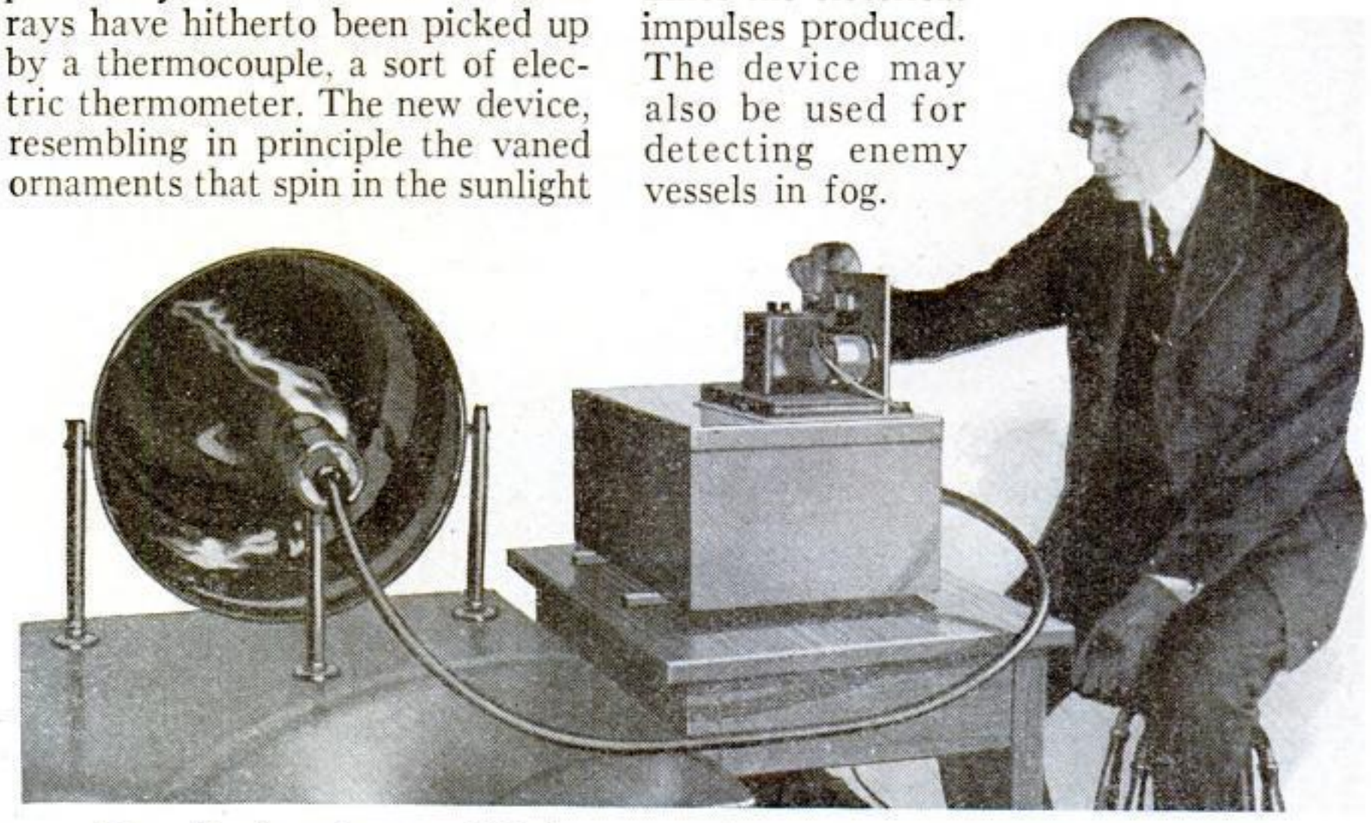
HANDY TOOL SIMPLIFIES HOOKED-RUG MAKING

BEAUTIFUL hooked rugs are declared easy to make with a new "rug needle," which dispenses with the use of a crochet hook for pulling yarn or strips of rag through the mesh of burlap. Turning a crank upon the labor-saving tool automatically forms the necessary stitches, looping the material evenly.

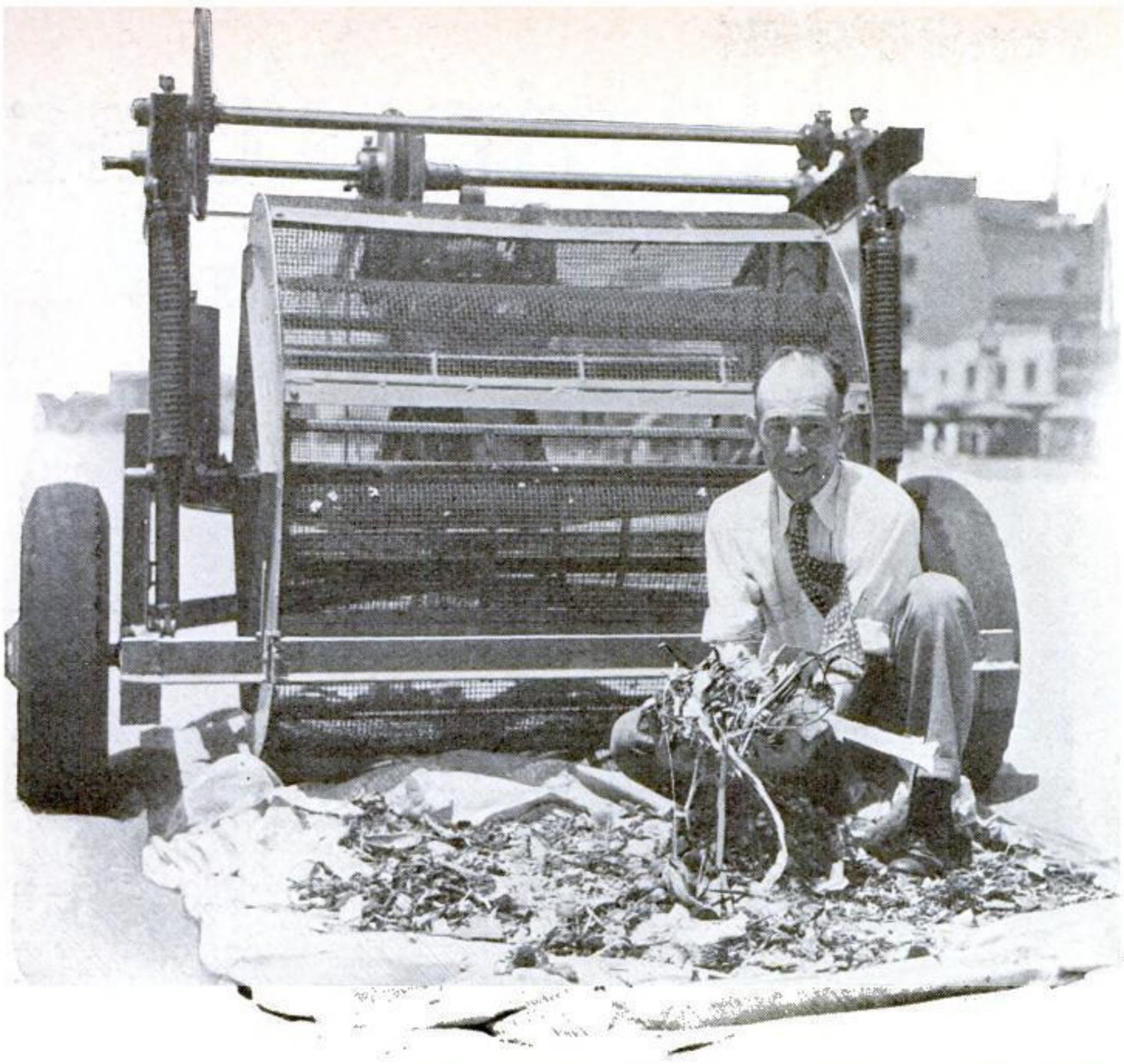


SIGNALING DEVICE USES BLACK LIGHT

PORTABLE military signal sets, using unseen beams of black light, are made practical by the invention of a receiving outfit 180 times as sensitive to infra-red rays as any previously known. These invisible rays have hitherto been picked up by a thermocouple, a sort of electric thermometer. The new device, resembling in principle the vaned ornaments that spin in the sunlight in jewelers' windows, utilizes the infinitesimal pressure of incoming rays to vibrate a thin aluminum diaphragm mounted in a cylindrical chamber at the back of a ray-collecting reflector. An amplifier magnifies the electrical impulses produced. The device may also be used for detecting enemy vessels in fog.



Ray-collecting reflector and the instrument that amplifies the black-light impulses



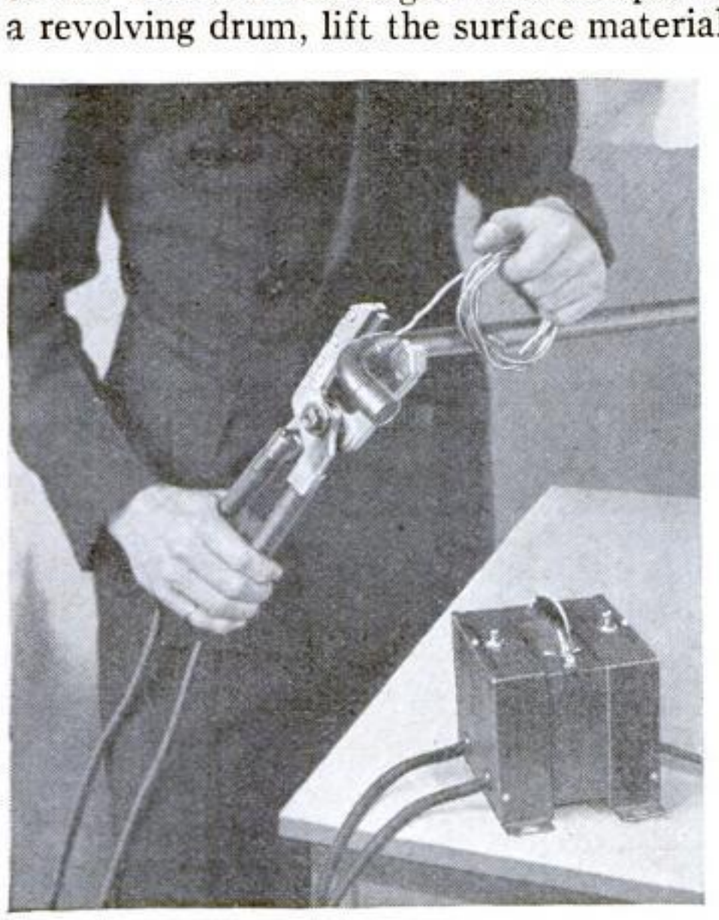
SIFTS SAND TO SPARE BATHERS' FEET

A MECHANICAL "beach comber" at Venice, Calif., shaves off the sand to a depth of four inches, screens it for glass, litter, and valuables, and returns the cleaned sand to the beach. Metal-edged wire scoops, in a revolving drum, lift the surface material into compartments which retain the litter but let the sand sift through. The cutting depth is variable from a fraction of an inch to four inches, and the machine cleans one and a half acres in eighty minutes at a cost of seventy-five cents an hour.

MOTHPROOFING EXPERTS RAISE THEIR OWN MOTHS

IN STUDYING the effects of a mothproofing compound, experts at a New Brunswick, N. J., laboratory maintain a unique moth farm. The moth larvae are raised in feathers as shown below, later transferred to glass bowls, and finally taken to a laboratory where they are placed on various samples of cloth which have been treated for protection against moths. The textiles are then subjected to microscopic and chemical tests to determine the effectiveness of the mothproofing treatment under varying conditions. Only by this means, the experts say, can moth activity be observed with scientific accuracy.

Moth larvae being selected to test mothproofing

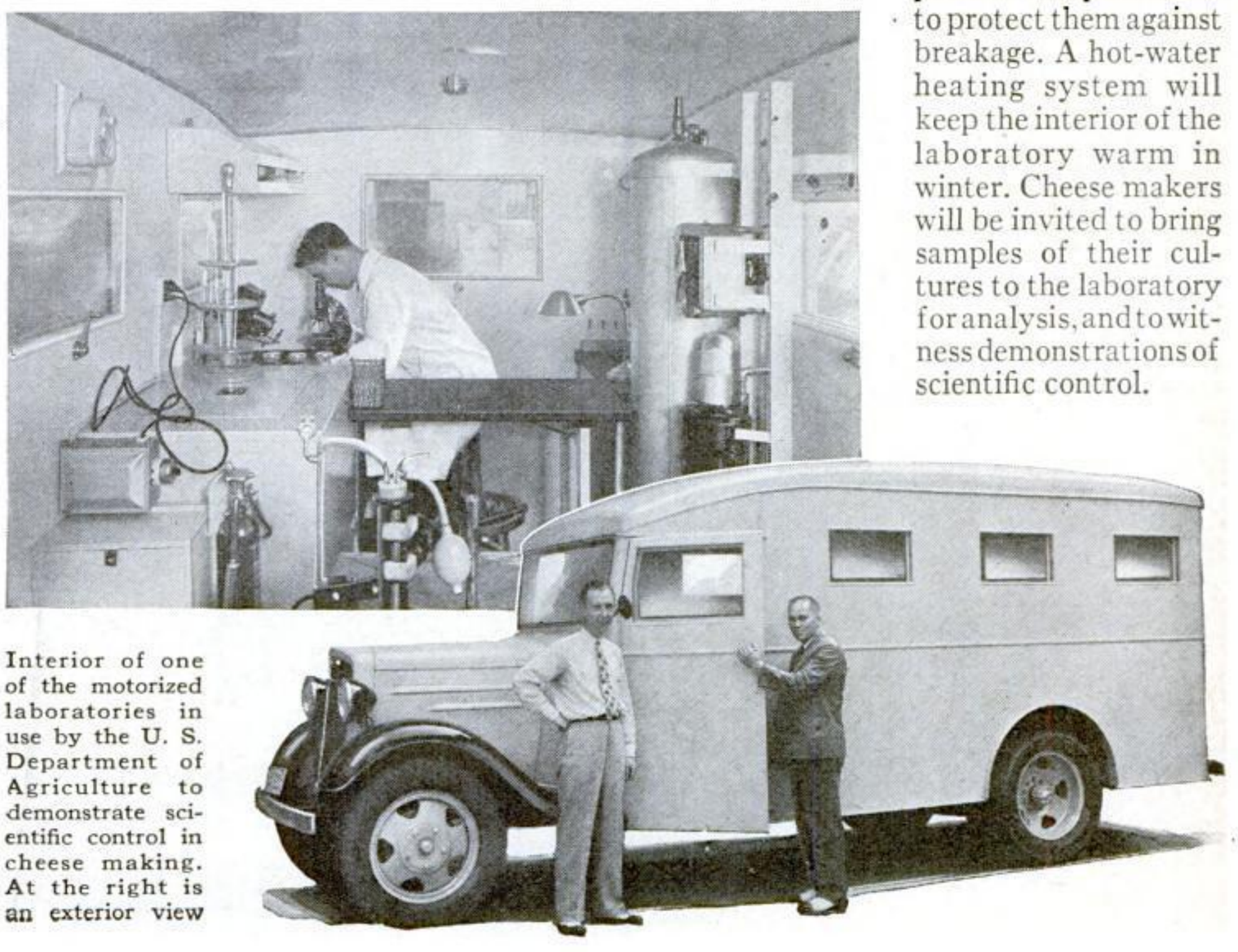


PLIERS HAVE HOT JAWS FOR MELTING SOLDER

ELECTRIC pliers of a type now available can be used to melt solder and to perform many other useful operations where heat is required. Current for the tool, which is illustrated above, is supplied to the jaws of the pliers through heavily insulated wires leading into the long handles. Although the device is designed primarily for use in sweating joints in copper pipes and tubes, it is said to be equally useful in other soldering operations, such as applying and removing solder lugs, and melting solder.

TRAVELING LABORATORY TESTS CHEESE

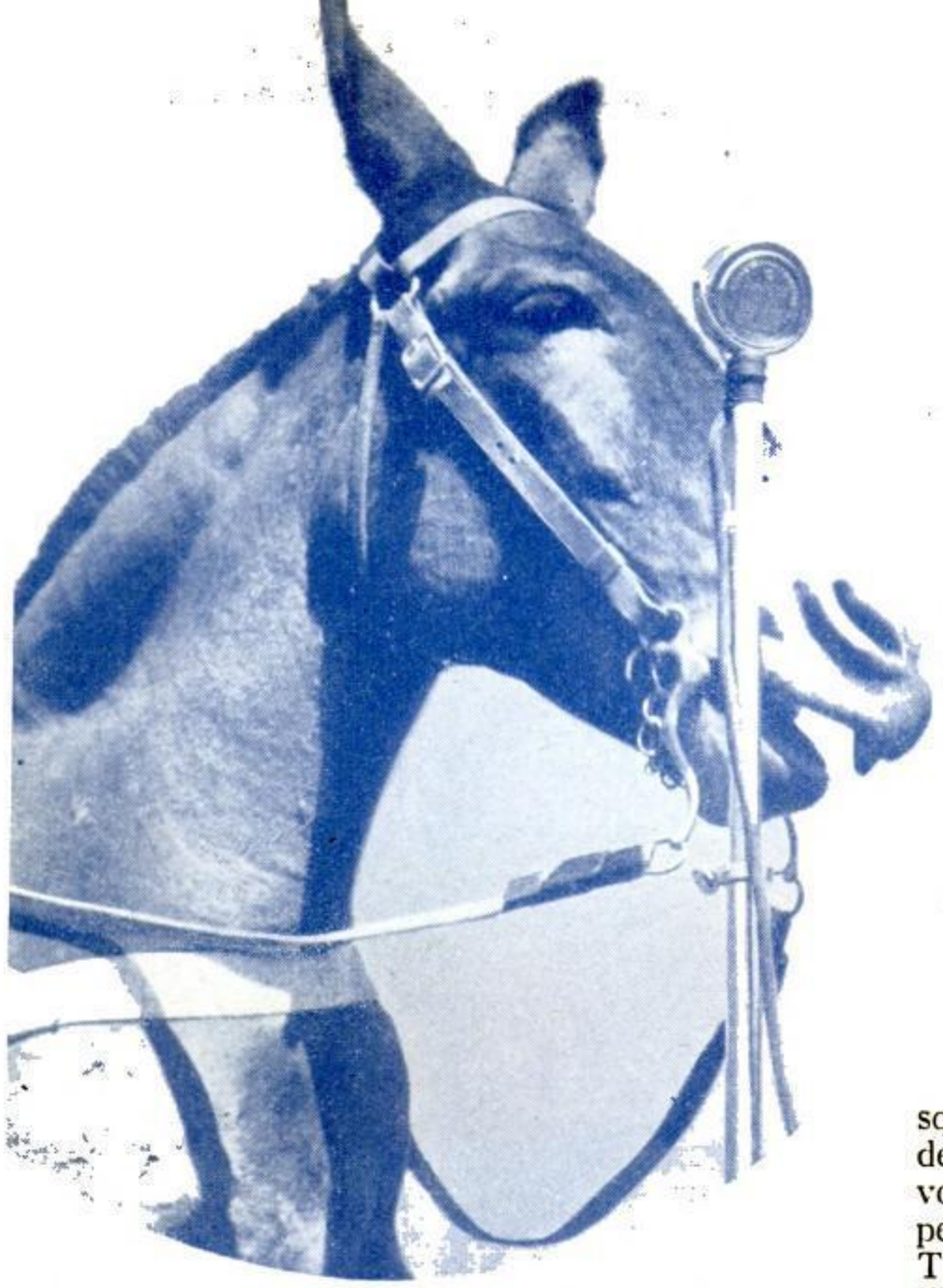
TO DEMONSTRATE the advantages of scientific control in the manufacture of Swiss cheese, the U. S. Department of Agriculture will send two "traveling Swiss-cheese laboratories" into Wisconsin and Ohio, largest producing centers in the country. Equipment for the laboratories includes hot and cold water, gas, and electricity. Pure cultures of bacteria will be kept in temperature-controlled incubators, while microscopes and other delicate instruments for use in testing cheese will be stored in padded compartments to protect them against breakage. A hot-water heating system will keep the interior of the laboratory warm in winter. Cheese makers will be invited to bring samples of their cultures to the laboratory for analysis, and to witness demonstrations of scientific control.



Interior of one of the motorized laboratories in use by the U. S. Department of Agriculture to demonstrate scientific control in cheese making. At the right is an exterior view

Name Your NOISE

. . . The Sound Libraries Have It Sealed in Wax



A trained mule "says a few words" into the microphone. The voices of nearly all animals have been recorded for realistic sound effects in radio programs, movies, and dramas

This is the recording equipment that is used by the National Broadcasting Company for "canning" noises of all conceivable kinds

Right, a phonograph disk of jungle noises recorded in Africa, with a book describing each animal and its individual habits

THOUSANDS of noises, ranging from the faint squeak of a shoe to the thundering roar of an erupting volcano, are now available permanently recorded in wax. The disks of modern "sound libraries" provide an amazing array of "canned" clamor that is providing many of the true-to-life sound effects in theaters, talkie sets, and broadcasting studios.

If a stage director needs the offstage whine of an airplane, for example, he can select a record of a one, two, or three-motored plane. He can have the engine idling or thundering at full throttle. He can pick a ship taking off, gliding, or going into a power dive with a gale screeching through its wires. Or, if he is staging a drama of the north woods, the sounds of rasping saws, crashing trees, and crackling camp fires are available at a moment's notice.

From every corner of the globe, records of odd noises are coming in to swell the nation's growing libraries of sound. Manufacturers' catalogues list an unbelievable range of subjects. And, almost as widely assorted as the sounds themselves are the uses to which they are put.

Radio and the stage, of course, make the greatest demands on the sound libraries. But schools are beginning to employ the records extensively. Dramatizations, recorded on disks, have invaded the classroom as a fascinating form of history texts. Stories recorded in foreign languages teach the students correct pronunciation.

An increasing number of amateur movie makers also are becoming regular customers of the sound libraries. Making home movies on regulation sound film is an expensive business, and these amateurs find it is cheaper to synchronize ready-made records with their silent pictures.

To make the wide assortment of records now available, sound engineers have visited zoos, set up their equipment on busy street corners, ridden speeding locomotives, and trekked through the African jungles. Just recently, technicians descended into one of the New York City subways to record the underground roar of the trains.

When recordings are made outside the sound studio, the portable equipment generally is mounted on a special sound truck. A thick composition wax disk is whirled on an electric turntable, ground smooth by metal cutting blades, and polished to a flawless surface. Sensitive microphones distributed at various points pick up the desired sounds and feed them to a control board. They are then grooved into the prepared blank record with a sapphire-pointed cutting stylus.

The disk is then scrubbed with distilled water, coated with graphite, and doused in an electroplating chemical bath. The outside coating solidifies, picks up the impressions in the wax, and is peeled off the composition base to form the master record. From the latter is derived the "stamper" which transfers the sound impressions to the familiar black phonograph records made of china clay and shellac.

Sometimes, in field recording, the sound is amplified to telephone pitch and wired directly into the studio through telephone lines. A somewhat similar method is occasionally used to relay radio programs by direct wire from the scene of a broadcast to the recording studio. Generally, however, programs are picked out of the air by conventional radio receivers, amplified, and wired to the recording machines.

More and more field recordings are constantly being made for sound collec-

Phonograph Records Preserve an Audible History Of Our Civilization, as Sounds of Daily Life Are "Canned" for Use in Movies and Radio

By
FAIRFAX DOWNEY

tions. While it is possible to produce adequate studio imitations of droning airplanes, barnyard noises, or the chants of Indians, recordings of the real thing have been found superior.

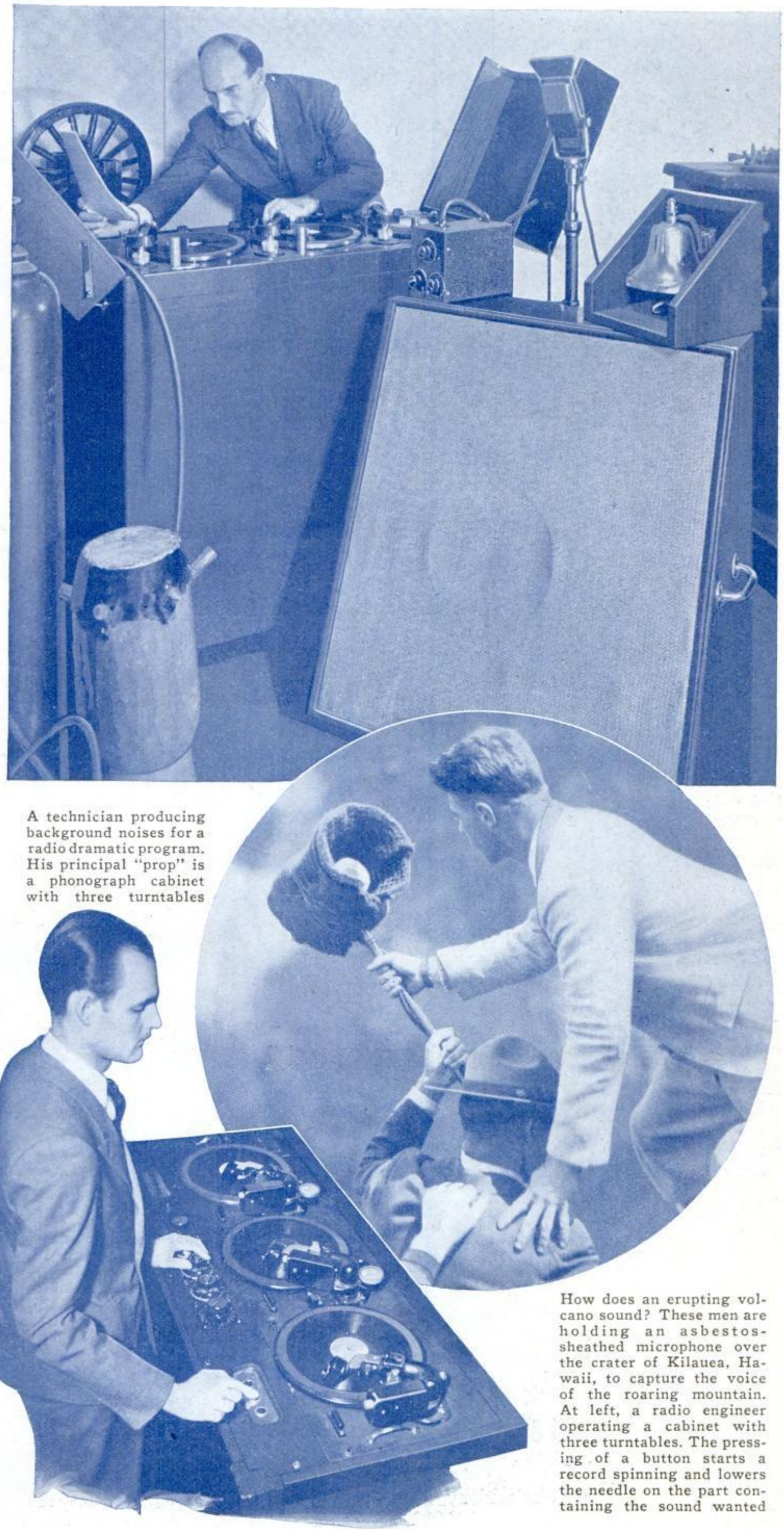
Sound records often are used in broadcasting even where the real thing is available. When Admiral Byrd was planning his radio broadcasts from Little America, he realized that you could lead sled dogs to a microphone but you couldn't make them bark—at least, you couldn't rely on them. So he had several barking-dog records made before he left on the expedition. Listeners who heard the growling and barking of dogs on the programs broadcast from the antarctic were hearing sound records made in the United States.

Records are gradually taking the place of sound props in radio broadcasting because it is much easier to turn on a phonograph than it is to rustle paper, rattle sticks, or beat on assorted kettle-drums, tin pans, and wash boilers.

Consider the plight of the sound-effects engineers who have to provide realistic backgrounds for household programs advertising cake flour, baking powder, floor wax, and similar products. They have had to simulate the sounds produced in beating cake batter, mopping floors, twirling egg beaters, opening cans, dropping spoons, closing ovens, lighting gas ranges, and a hundred other household operations. The sounds have to be exact, or the listening housewives will swamp the station with criticisms.

So many varied utensils were needed for these programs that one station rigged up a complete rolling kitchen cabinet jammed with spoons, cups, bowls, tin cans, and numberless other implements. At the start of each household program, this was trundled from the storage room to the broadcasting studio. Now, this cabinet is being replaced by a compact collection of sound records. Eight or ten separate sounds can be concentrated on one record, and one or two disks will provide the authentic background for the preparation and cooking of a whole meal, or for an attic-to-cellar housecleaning over the air.

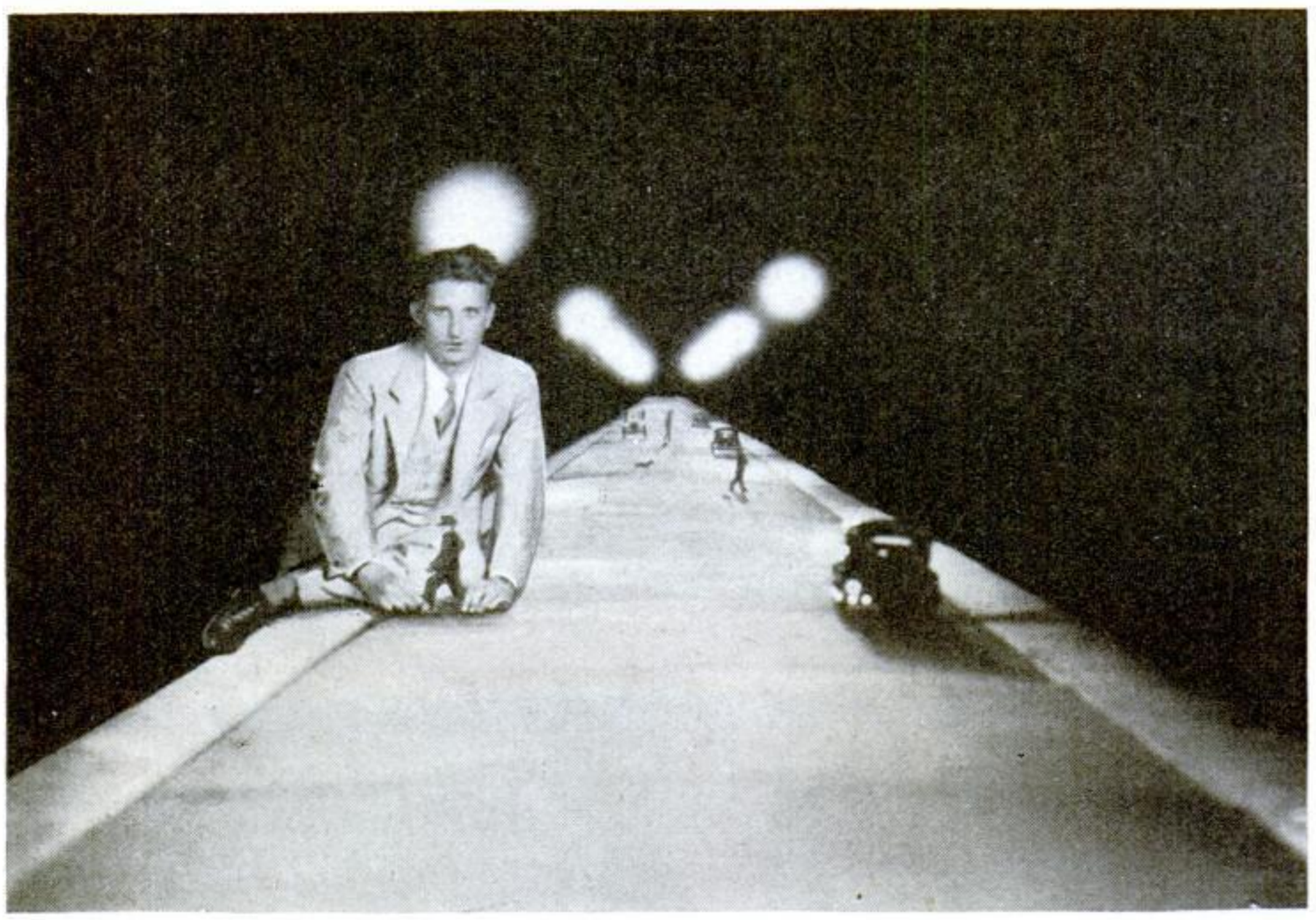
Sound disks used in radio studios, on moving-picture lots, and in the wings of theaters are played on a cabinet equipped with from one to three turntables, electric phonograph pick-ups, amplifiers, and loudspeakers which respond to a wide range of tones. Records are played over in rehearsal, and an indicator on each turntable is set to show the exact groove which produces a required sound. During the performance, the operator poises the playing needle over the correct spot. When he gets his cue he presses a release button which starts the turntable and lowers the needle onto *(Continued on page 104)*



A technician producing background noises for a radio dramatic program. His principal "prop" is a phonograph cabinet with three turntables

How does an erupting volcano sound? These men are holding an asbestos-sheathed microphone over the crater of Kilauea, Hawaii, to capture the voice of the roaring mountain. At left, a radio engineer operating a cabinet with three turntables. The pressing of a button starts a record spinning and lowers the needle on the part containing the sound wanted

Safety Lighting Drives



The highway model at the Nela Park laboratories in Cleveland, Ohio, used in lighting tests

By
WALTER E. BURTON

ON A 250-FOOT MINIATURE BOULEVARD, ENGINEERS USE MODEL MOTORS AND MEN AS COUNTERS IN A GAME TO SAVE LIFE

IN A strange laboratory at Cleveland, Ohio, research engineers spend their days playing with toys. On a miniature automobile highway the length of a city block, they arrange tiny models of men, motor cars, and dogs; then they throw switches that flood the make-believe boulevard with various kinds of light from every possible angle. Though any child might envy them their gigantic plaything, their fascinating game is no idle pastime. Their experiments may result in saving thousands of lives through better highway illumination at night.

While the problem of lighting roads and streets has been studied for many years, its true importance has been realized only recently. A public aroused by the mounting death toll of the automobile has demanded to know the reasons why there are so many motoring accidents; in a surprisingly large number of cases, the blame can be laid at the door of a sinister hazard of the highway—darkness.

Death has become a night rider. While safety campaigns have been successful in reducing the number of daytime accidents, the night fatalities are increasing at a rate swift enough to make any driver pause and think. Traffic records show that from three quarters to four fifths of all the cars traveling the nation's highways in a given twenty-four-hour period do so in the daytime. Yet more than half of the accidents causing death, and almost half of those that merely demolish cars and do other damage to persons and property, take place in the hours of dusk and darkness.

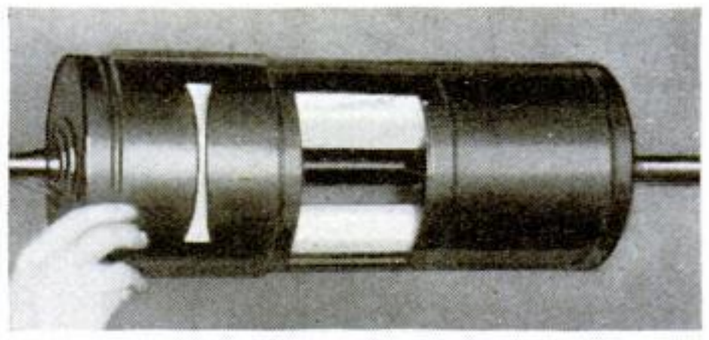
Another startling fact disclosed by recent statistics is that, of all the 3,000,000 miles of roads in the United States, there are some 50,000 miles along which practically all of the accidents occur. Of these, unlighted rural highways are by far the most dangerous. On these 50,000 murderous miles, for every mile you drive, you are six times as likely to collide with other cars, telephone poles, or pedestrians at night as in the daytime; if you drive equal distances by night and by day, you are ten times as likely to be killed after darkness has fallen.

The stringing of safety lights on poles along these 50,000 deadly miles would, in a single year, save 5,000 lives, 50,000 personal injuries, and 100,000 cases of property damage. These are the figures offered by lighting men who have studied every angle of the problem of nighttime highway safety.

Much of this study has been carried out at the Nela Park laboratories of the General Electric Company, in Cleveland. Kirk M. Reid and H. J. Chanon have conducted the researches, with the coöperation of such well-known lighting authorities as Dr. M. Luckiesh and Frank K. Moss.

Unlike former highway test models of its kind, the miniature traffic artery at Nela Park is comparatively large, being 250 feet long. As it is constructed on a scale of eight to one, so that an inch and a half on the model represents a foot of actual roadway, this 250 feet is the equivalent of a 2,000-foot stretch of highway.

The model highway is incased in a light-proof tunnel. It is provided with interchangeable "paving," so that surfaces representing asphalt, brick, oil-polished con-

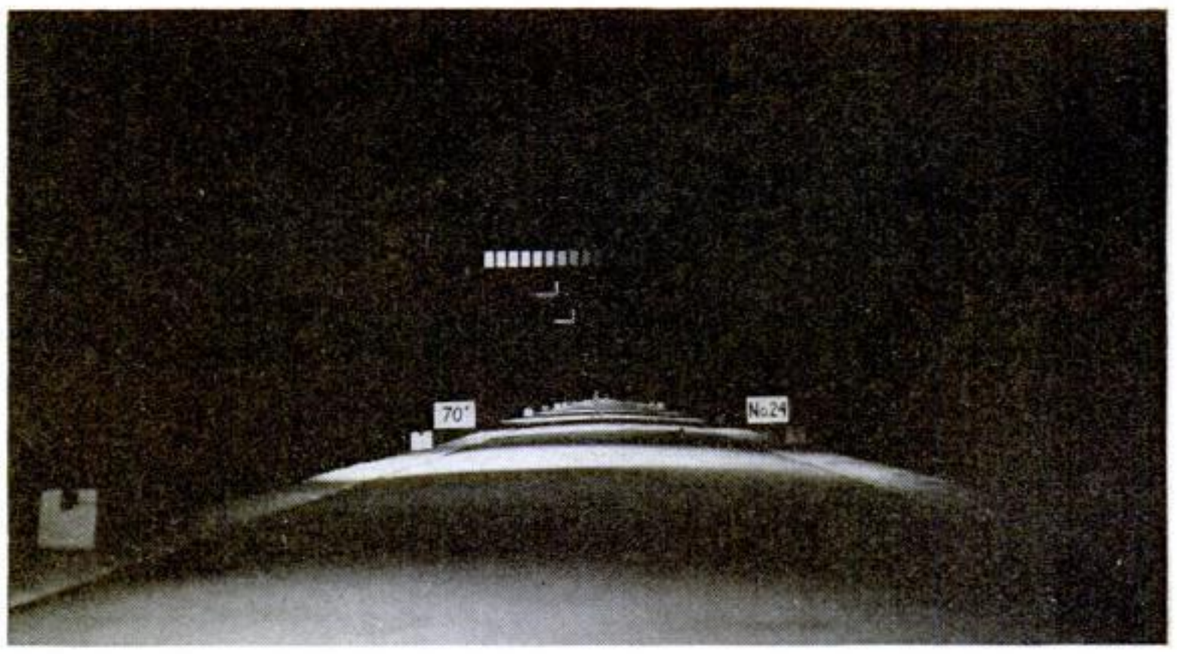


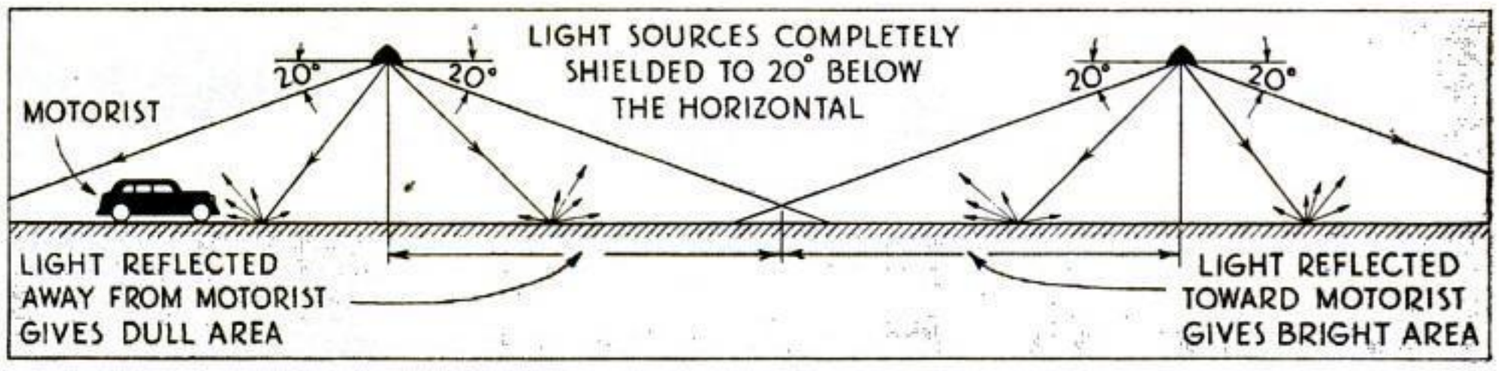
One of the special lighting fixtures used on the miniature roadway. The aperture is adjustable

The Test Model Under Ordinary Road Lights

SPOTTY LIGHT DISTRIBUTION

This view along the model highway shows the effect of ordinary road lighting. Because of the angles at which the rays of light strike the road surface, dark areas are created as illustrated by the drawing below, and set up hazards

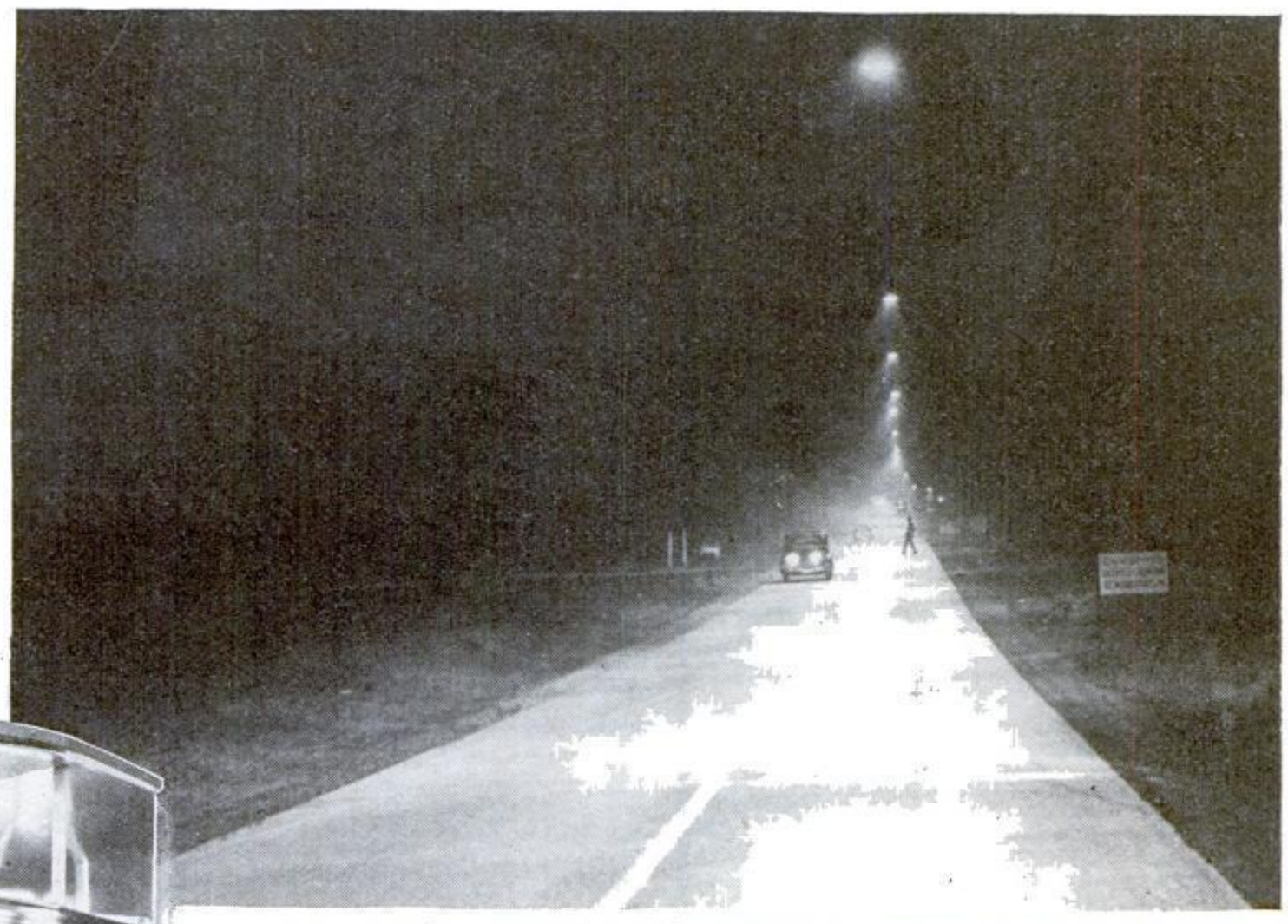




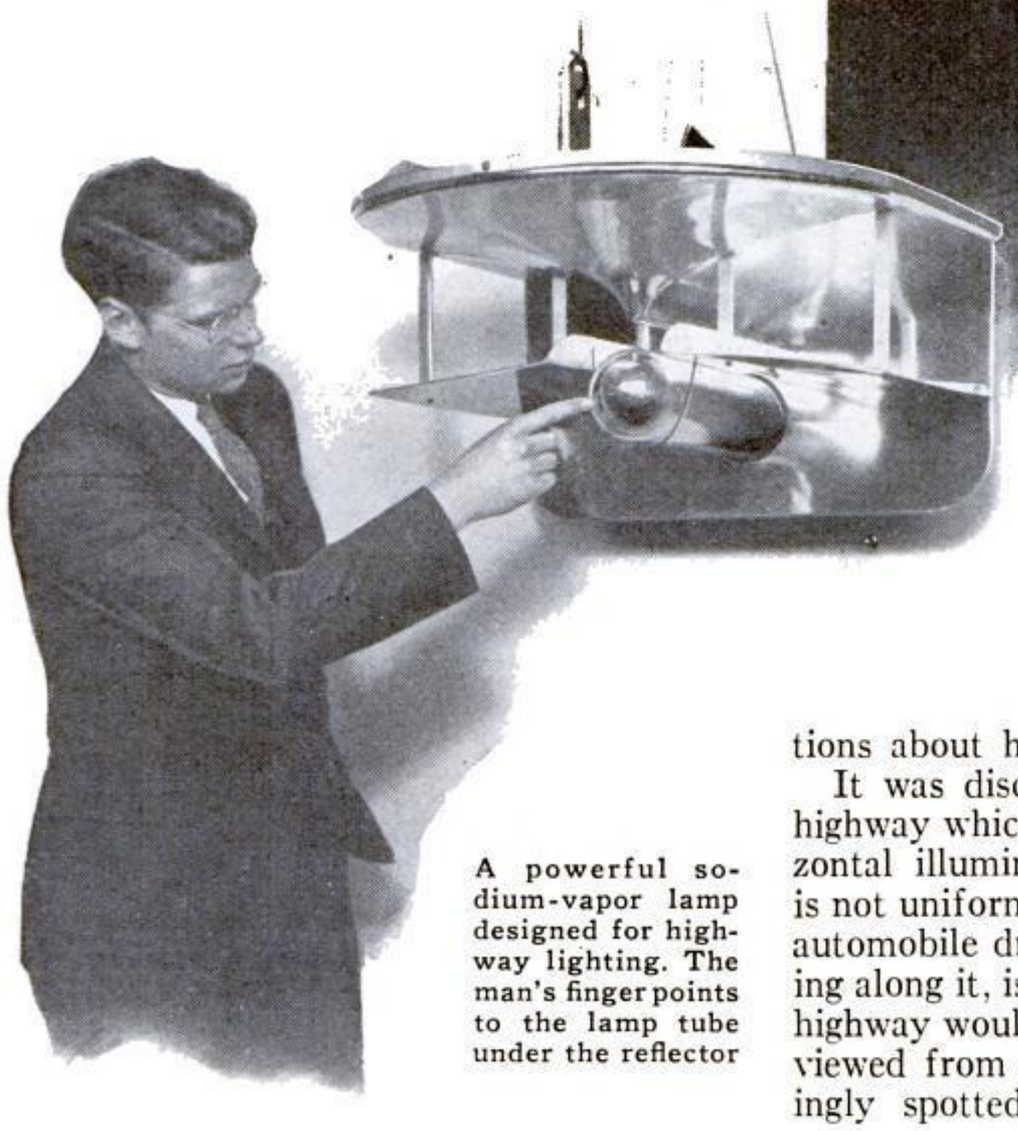
Death Off the Highway

crete, and other kinds of road material can be studied. Above the forty-six-foot roadway are mounted incandescent, mercury-vapor, and sodium-vapor lamps, in fixtures which can be adjusted as to height and lateral position. From the control panel of this model highway extend five miles of wire and a mile of cord, required for manipulating the lighting and other equipment. Scale-model automobiles, men, and even dogs can be placed at various parts of the road, so that observers can study how easily they could be seen by a Lilliputian motorist driving his car down this artery with its quota of highway traffic.

The mass of facts obtained by thousands of observations, which involved many different persons as observers, has been boiled down and crystallized into a number of important revelations about highway lighting.



A stretch of actual highway illuminated in accordance with the principles discovered on the laboratory model. Note how clearly distant objects can be seen



A powerful sodium-vapor lamp designed for highway lighting. The man's finger points to the lamp tube under the reflector

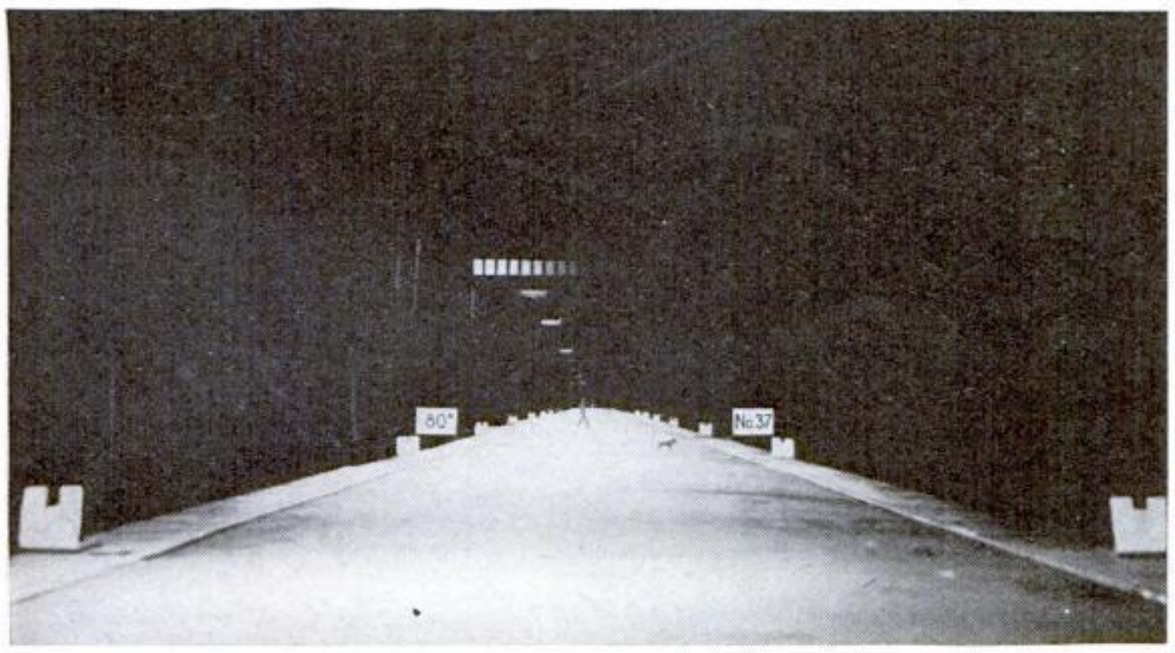
It was discovered, for instance, that a highway which has perfectly uniform horizontal illumination throughout its length is not uniformly lighted at all as far as the automobile driver, or the pedestrian walking along it, is concerned. Although such a highway would appear uniformly lighted if viewed from an airplane, it looks confusingly spotted to the motorist. This is because the light that is of greatest importance to the driver is that which is reflected from the road surface at small angles. Even on a decidedly dead-finish or mat pavement, this reflection is considerable, and important. Only the light reflected toward the driver is useful. That bounding away from the car is of little help, as your headlights may have indicated on many roads, particularly wet ones.

Studies with the model highway revealed that the silhouette figure holds high place in night driving. That is, for more than eighty percent of the locations on a roadway lighted by a representative highway-lighting system, objects are seen as silhouettes, dark against a lighter background. The person who stands up in front of you while you are watching a moving picture in a theater is, as far as you are concerned, nothing but a silhouette. The same is true, in eight cases out of every ten, of the automobiles, dogs, men, and other objects you see on a lighted roadway at night.

And so it became evident that one important way of increasing highway safety at night is to illuminate the pavement so that it appears uniformly bright, to make objects on it stand out sharply to the driver or pedestrian. It was found that a light-colored, mat pavement is best, whether illuminated by overhead lamps or by automobile headlights.

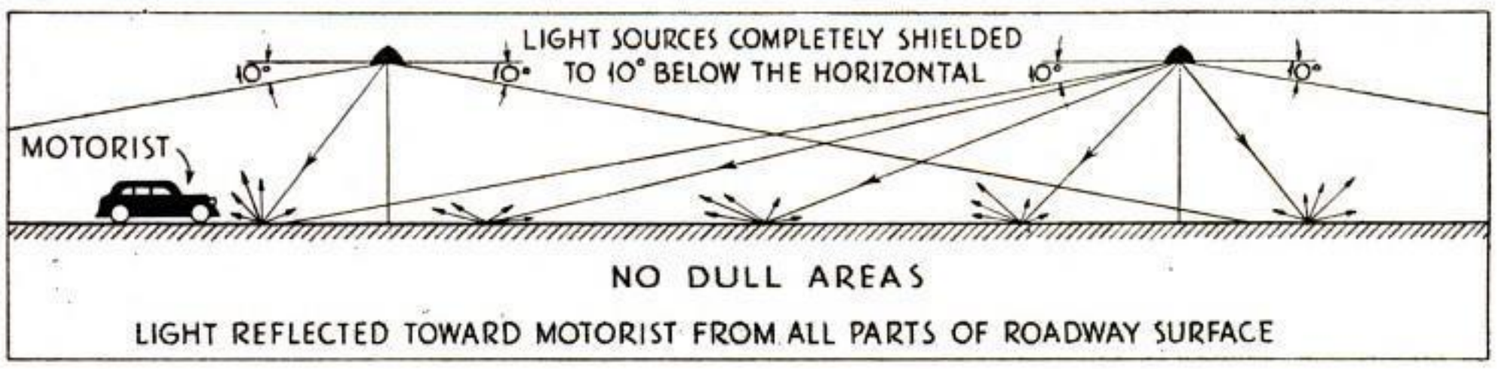
The growing controversy among lighting men as to which is the best for roadway lighting, the familiar incandescent lamp, the new mercury-vapor lamp, or the new sodium-vapor lamp, seems to have been settled by studies with the model roadway. The answer is that, from the standpoint of safety, there is not enough difference to argue about. With equal amounts of light equally distributed, a motorist or pedestrian sees an object just as far away and just as quickly with one *(Continued on page 109)*

. . . And With Scientifically Designed Equipment

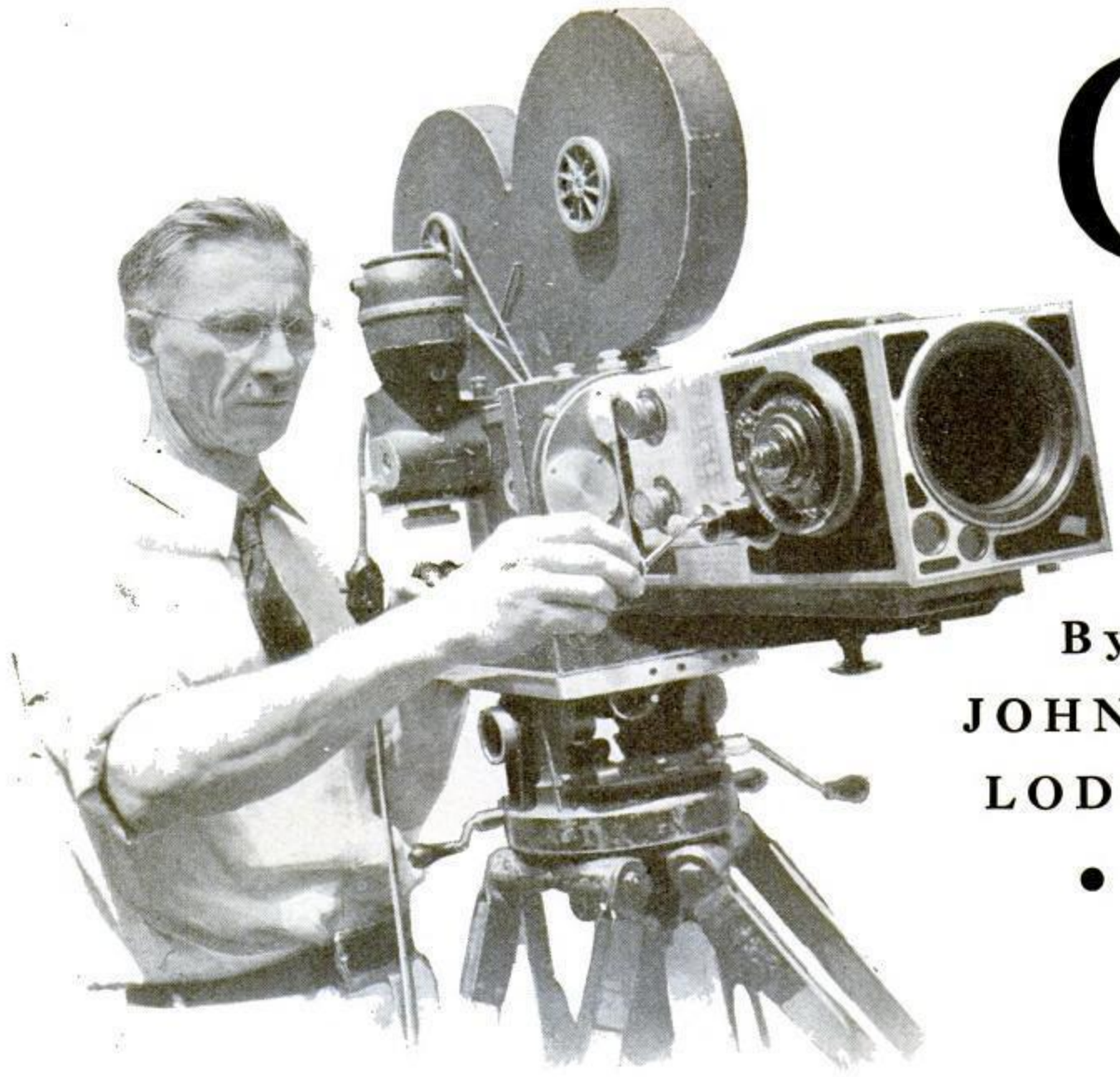


EVEN LIGHT DISTRIBUTION

In this case, the light sources are shielded to suppress glare, and the dark areas in the other picture are eliminated. The models representing a pedestrian and a dog now stand out plainly, whereas in the contrasting view they do not



Camera BRING NEW



This camera is equipped with a zoom lens which makes it possible to move in from a long shot to a close-up while keeping always in focus

By JOHN E. LODGE

LENSES containing not one but 220 individual openings; zoom lenses which focus from long shot to close-up in the twinkling of an eye; high-speed cameras which slow down motion for comedy and dramatic effects; cameras clothed in oilskins for shooting indoor storms; moving paintings on glass which surpass nature in beauty; chemical baths and double exposures; and a variety of focusing devices, movable platforms, and booms make possible the creation and filming of motion-picture effects which until recently were only figments of a vivid Hollywood imagination.

When a cameraman goes on the set today, whether indoors or out, he may use any of a dozen lenses before nightfall as he crouches in a pit to film the lunging of a wild horse, rides a silent elevator to peer in through the windows of a six-story building, draws away from dancing actors while his follow-focus apparatus keeps their images sharp on the film, or rides a camera crane around a circle to photograph a man-made storm.

Often rain falls, winds howl, and gales lash at stricken ships in Hollywood, but the storms are artificial—and several times more convincing than the real thing. The other day, a director wanted to show an automobile drawing a trailer bumping along a rough country road as rain fell, wind howled, and lightning crashed. In short order, his cameraman suggested a quick and inexpensive means for shooting the sequence.

Carpenters built around the edge of a large tank a circular set representing a section of wooded country. Hundreds of feet of perforated pipe were put up to carry the rain. Lightning machines were placed offstage. Finally, the camera crew mounted a long metal boom, crawled under oiled coverings, brought the camera to a focus, and were ready for action. For three minutes the automobile plowed through the thick gumbo as the camera followed the circular track, and when the director called "cut," the camera had recorded a dramatic scene produced indoors under the glaring arcs and inkies—a scene impossible to get under natural conditions.

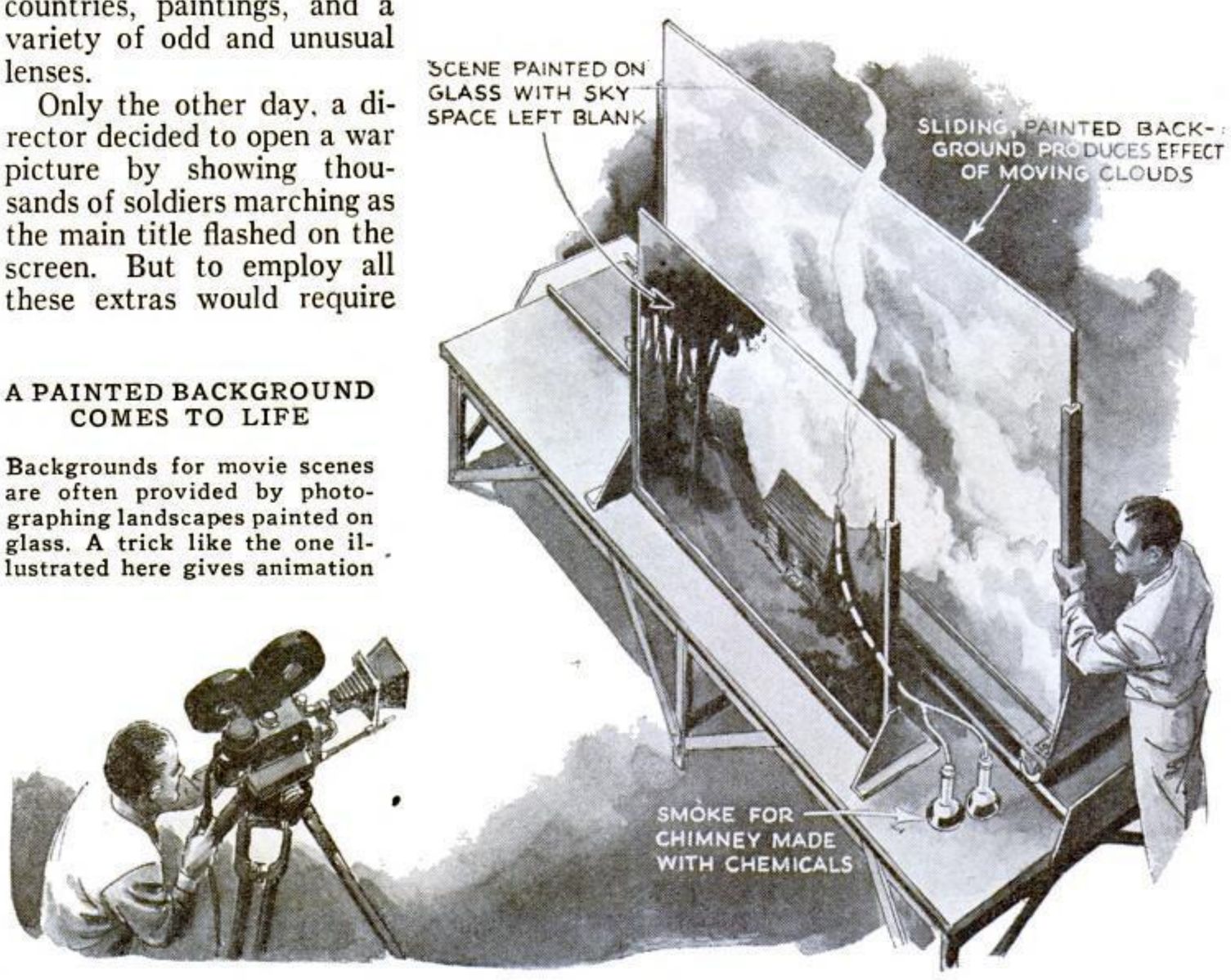
Cameramen employ many artifices to "get their picture"—not with the idea of fooling the audience, but because realism and cost may require the use of miniatures, synthetic storms, combinations of close-ups shot on the stage with background filmed in foreign countries, paintings, and a variety of odd and unusual lenses.

Only the other day, a director decided to open a war picture by showing thousands of soldiers marching as the main title flashed on the screen. But to employ all these extras would require not only outfitting them at large cost, but also payment of wages for one or two days. So the cameraman on the job told the director that if he would provide twelve men in uniform, he would turn them as if by magic into several battalions.

Two days later, the movie soldiers stood on a sound stage, and on command walked slowly past the camera. Mounted in front of the regular photographic lens was the button lens, the only one of its kind in existence. As the men marched, an assistant slowly revolved the button lens. When, later, the negative was developed and projected, countless thousands of soldiers appeared to be milling around on the screen. Through a complicated grinding of a flat plate of glass, there had been achieved 220 separate oval lenses which have the effect of multiplying the images many times. The cameraman can shoot through either the entire glass or a small section, depending upon the multiplication of numbers desired.

When a director shooting an air picture called for a plane to spin directly toward the camera, safely anchored on the ground, the cameraman had the answer. He placed an auxiliary prism lens on the machine and, when the airplane glided in straight flight toward the earth, revolved the prism so that the image turned over and over.

But these lenses are only two of many which produce odd and unusual effects. There are the zoom lens, triangular mirrors, a lens which changes focus automatically when approaching or backing away from actors, and two-way prisms which enable the camera to look down two

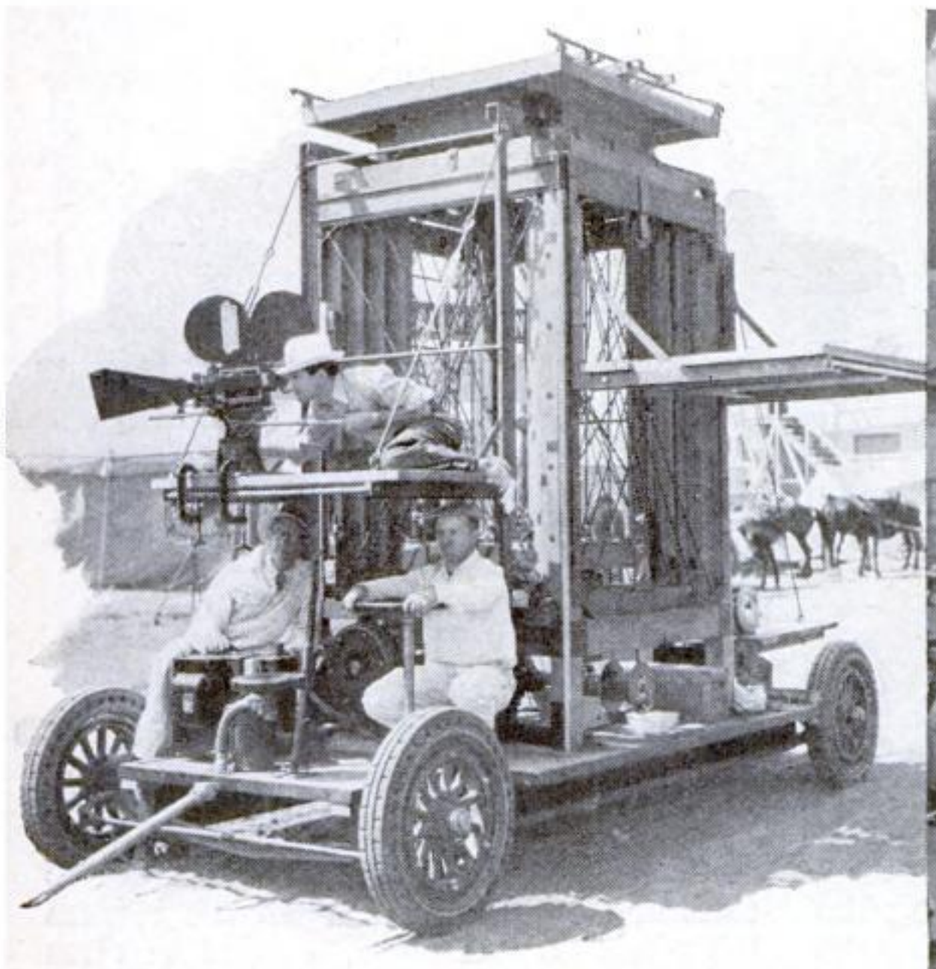


A PAINTED BACKGROUND COMES TO LIFE

Backgrounds for movie scenes are often provided by photographing landscapes painted on glass. A trick like the one illustrated here gives animation

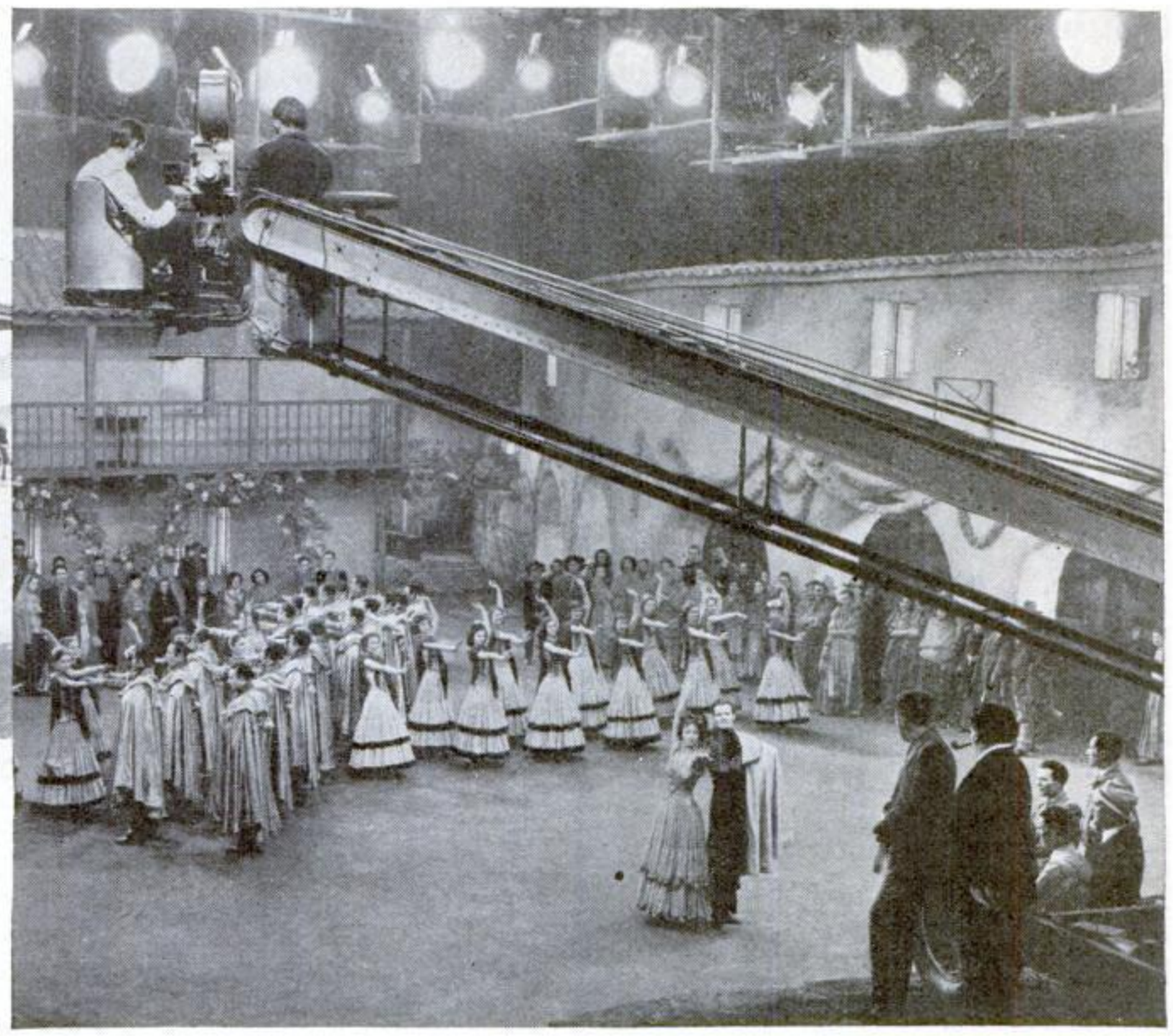
Wizards of the Movies

REALISM TO THE SCREEN



POINTS OF VANTAGE FOR THE CAMERA

A rolling platform from which five cameras can operate at once to film large scenes such as stampedes and battle sequences. At the right, a huge steel crane is being used in photographing dancers in a recent musical production



streets from a corner simultaneously. There are two, three, four, and seven-way prisms, and reflecting lenses which permit the camera to photograph scenes while pointed aside at a right angle.

Only one zoom lens exists in Hollywood today. With this remarkable device, a camera can move in for a close-up in a fraction of a second. In a recent courtroom scene, the camera was focused from a distance of ten feet on an actor representing the district attorney. As he closed his address to the jury, the camera was dollied back fifteen feet, to show him surrounded by a group of friends. Meanwhile, the follow-focus device, attached by means of gears and cams to the wheels of the dolly, kept the camera in focus. Now the dolly rolled back to its original position, when suddenly the zoom lens was turned, picking the actor out of the crowd full head size. This feat, impossible in the past, is achieved by moving three units of a single supplemental lens mounted in a big black box on the front of the camera. Bringing them together gives a long shot, while moving them apart bends the rays of light entering the box to give a close-up.

Then, there's the lens that produces "goofy" effects. This is a flat, circular lens made of plate glass distorted on one side by irregular indentations. In a recent picture, a composer was shown working wearily at his music, until he became so fatigued that he imagined he heard several orchestras playing his scores. Then the vision appeared—orchestras moving up and down, wraithlike. The lens, revolved slowly, had so bent the rays that straight lines appeared to wriggle.

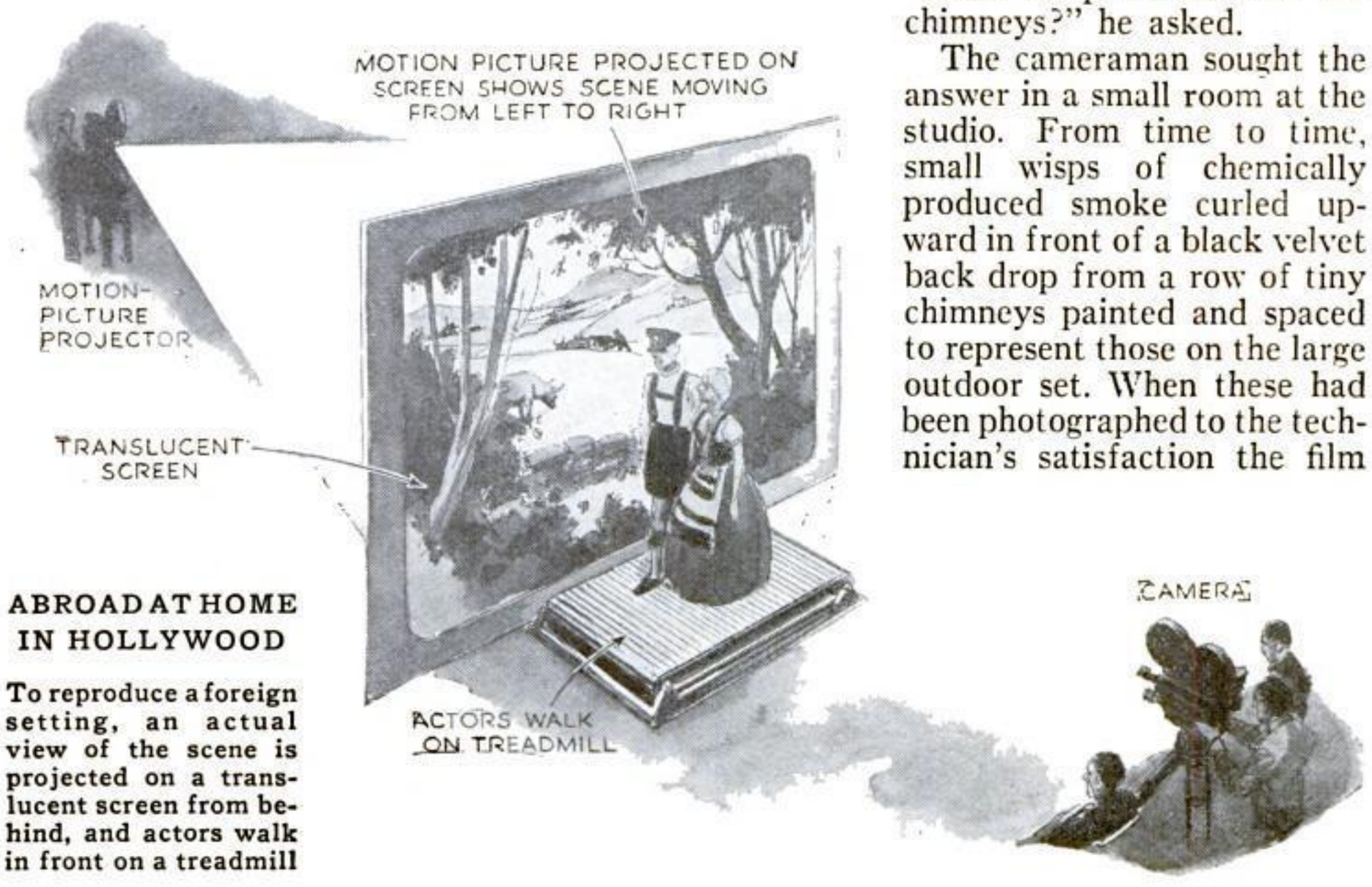
The forty-five-degree reflecting lens permits a camera set at right angles to the line of travel to record the approach of galloping horses and show them passing directly overhead. During this episode, the camera remains stationary while the reflecting lens is turned by means of a gear. This lens is an optical glass plate, its surface silvered so that it reflects light into the camera without loss.

For one type of scene, cameramen shoot through a triangular tube ten inches deep. All three sides are lined with mirrors. As the triangle revolves on ball bearings, images bounce back and forth from mirror to mirror, until finally the hodgepodge of images enters the camera. While only a small part of the film is exposed directly to the light, reflected images fill the frame and produce a multiple-exposure effect without visible lines between images.

Lenses and cameras alone do not solve all the picture-making problems, however, and cameramen constantly are finding ways for meeting difficult situations. For two weeks a director shot scenes showing a Chicago street, in reality on a movie ranch near Hollywood. When he viewed the scenes later, he decided that the backgrounds themselves needed more life.

"Can't we put smoke in the chimneys?" he asked.

The cameraman sought the answer in a small room at the studio. From time to time, small wisps of chemically produced smoke curled upward in front of a black velvet back drop from a row of tiny chimneys painted and spaced to represent those on the large outdoor set. When these had been photographed to the technician's satisfaction the film



ABROAD AT HOME IN HOLLYWOOD

To reproduce a foreign setting, an actual view of the scene is projected on a translucent screen from behind, and actors walk in front on a treadmill

showing the chimneys was superimposed on the original negative and the smoke "double" exposed. Where, before, the chimneys were lifeless, they now gave off gray smoke which eddied up toward the sky.

Sometimes, when nature refuses to produce just the sort of clouds a director wants, he shoots the picture against a blue sky. Later, his first cameraman sets up a high-speed machine against a velvet curtain and films artificial clouds, laid in layers upon the floor. When stripped in above the earth in the outdoor scenes, they look as realistic as those supplied by nature.

Or, the beautiful clouds you see floating high above a rural landscape may be painted on glass—and you can't tell the difference. This cloud effect is produced by photographing two paintings. In the foreground is an artist's reproduction of the general scene, painted on plate glass measuring three by four feet, while one foot behind this are the clouds, on a glass which moves at right angles to the camera. Thus motion is supplied, giving animation to what would merely be a still picture.

TRICKS with the camera, and also with the film in the laboratory, make possible the packing of more action into the same footage than was possible a few years ago. The lap dissolve, for instance, or the space shot. The lap dissolve, which is also known as the "dissolve interlace," saves considerable time and many scenes in telling a story on film. Where formerly an actor would be shown leaving his chair, opening the door, walking through the gate, entering his car, and driving off, now sound permits him to say, "Let's go," and he and his companion start across the room and gradually dissolve into the following scene. This is accomplished by fading the last few feet of the first scene and the first few feet of the second, and then double-printing.

The space shot makes possible swift action without a feeling of jumpiness. Here the camera is "panned," or swung around, quickly, from one scene to the next. Once more, a little trickery is the method. After panning, the cameraman "cuts," and later the new scene is opened by panning the camera toward the setting, thus getting the effect of continuous motion.

Cameraman and artist together can create nearly any foreign scene desired, either in the studio or on a near-by location. Through the medium of a painting on glass combined with a moving picture of only part of the scene finally portrayed, many locales may be achieved.

These glass shots produce some rare photography, which only an expert versed in the ways of the trick photographers could detect. Here's how they are produced:

On a sound stage, only part of the setting is constructed—say, the quarter-deck and forward turrets of a battleship. Masts, bridge, and the rest of the superstructure exist only as an idea. When the camera is trained on the scene, a piece of glass whose upper part is painted black obscures the background above the skeleton set. Meanwhile, in the studio laboratory an artist paints on a second glass the missing parts and such distant scenery as may be desired. Following the filming of the stage set, the negative is carried to the trick department and threaded through a camera anchored in a fixed position. This camera is focused on the painted glass, and the picture is photographed. Being carefully matched, the two blend in along the wavy line at the edge of the painting and, if the camera adjustment is proper, painting and setting cannot be distinguished.

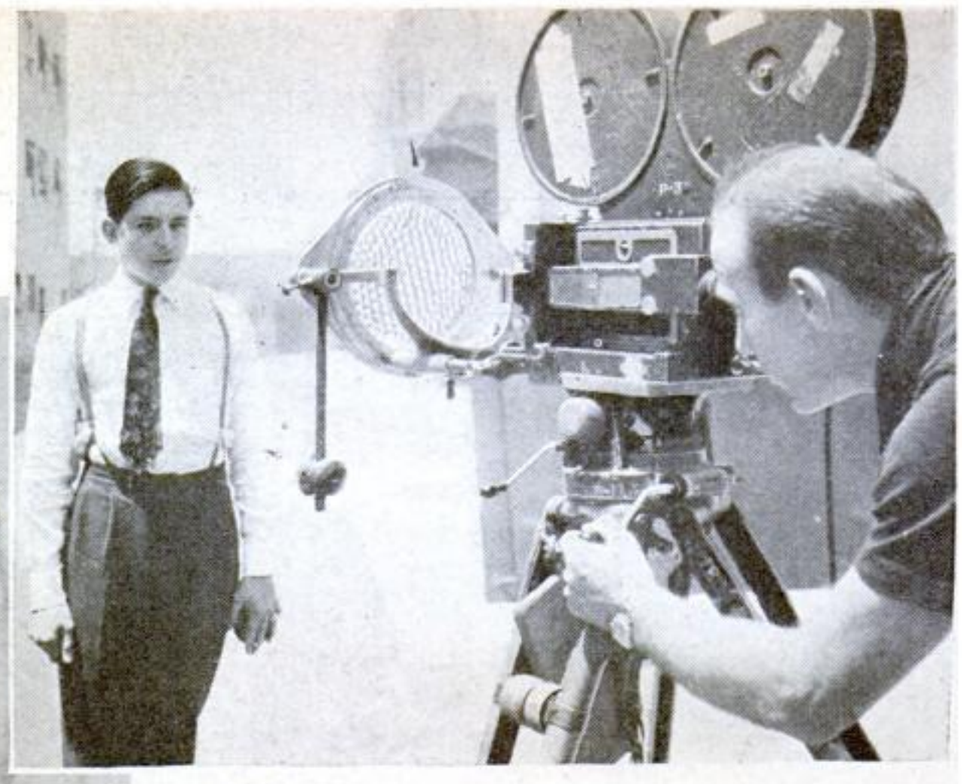
Recently, just such a setting was photographed, and when it appeared in theaters audiences saw not only the complete battleship, but also the San Francisco Golden Gate Bridge in the distance and moving water off the bow of the dreadnought. The water was double-exposed into a blank spot on the film left for just that purpose. Mario Larrinaga, famous movie artist, painted the battleship and bridge scene in five days, at a relatively small cost, whereas to have constructed the full-size setting would have required an outlay of $50,000.

SIMILARLY, another picture showed the harbor and mountains of Rio de Janeiro, Brazil—yet the picture was filmed on the beach near Santa Monica, Calif. The skyline was "matted out," and later put into the picture by means of a painting on glass.

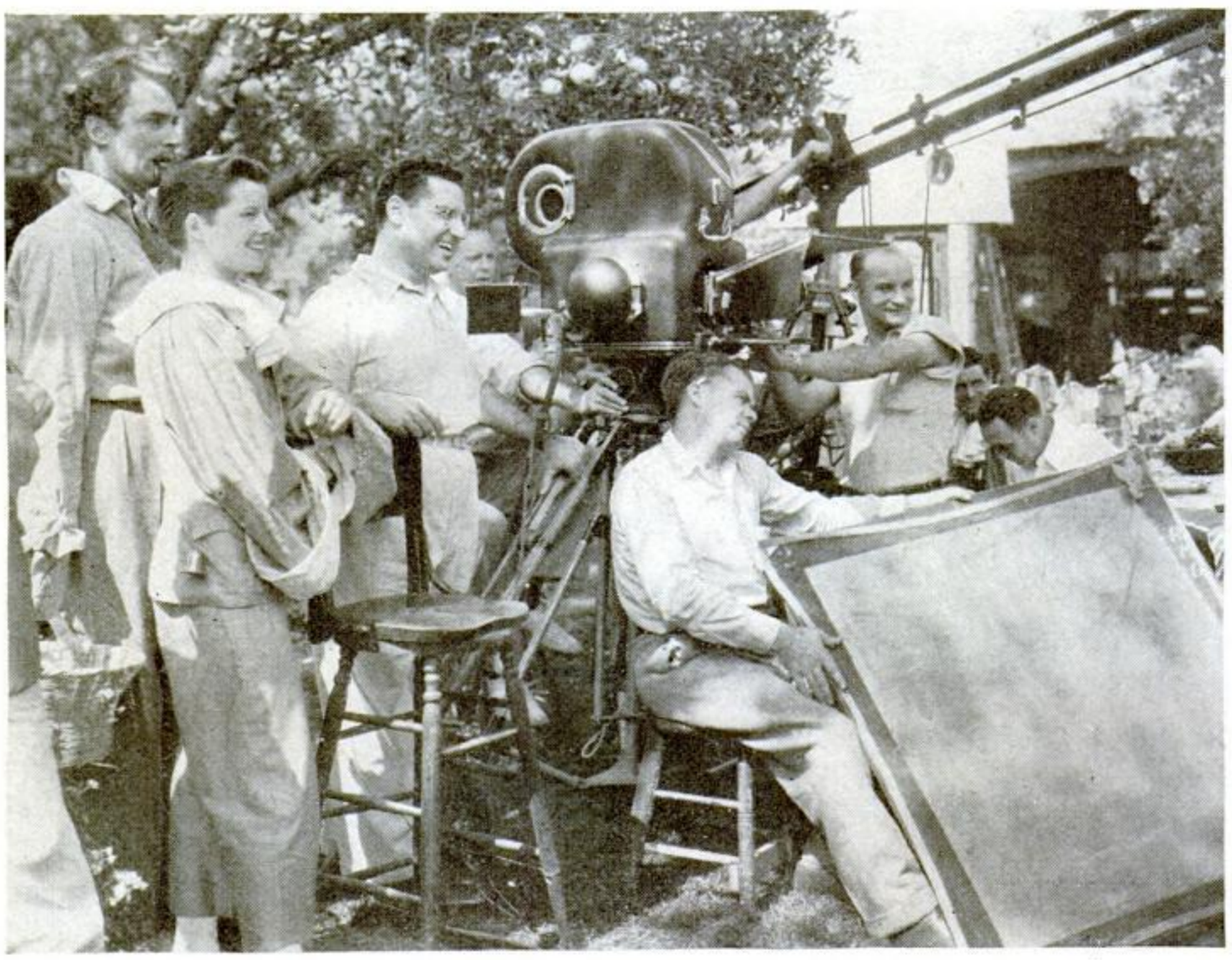
Frequently, the movie makers photograph a moving picture on a screen in order to match close-ups of actors with some distant scene. This is known as "process projection." Suppose, for instance, the script calls for a young couple to stroll along a Finnish countryside, with a village appearing in the distance. To carry them to Finland for the purpose is obviously too expensive, so the camera is set up facing a screen of transparent material with its surface *(Continued on page 109)*

WHEN ONE'S A CROWD

The button lens, a flat glass ground to form 220 separate lenses, multiplies an image many times. The picture below was made as shown at right



And here's the reflecting lens that makes the horses in a movie seem to gallop right over your head. The crank turns it

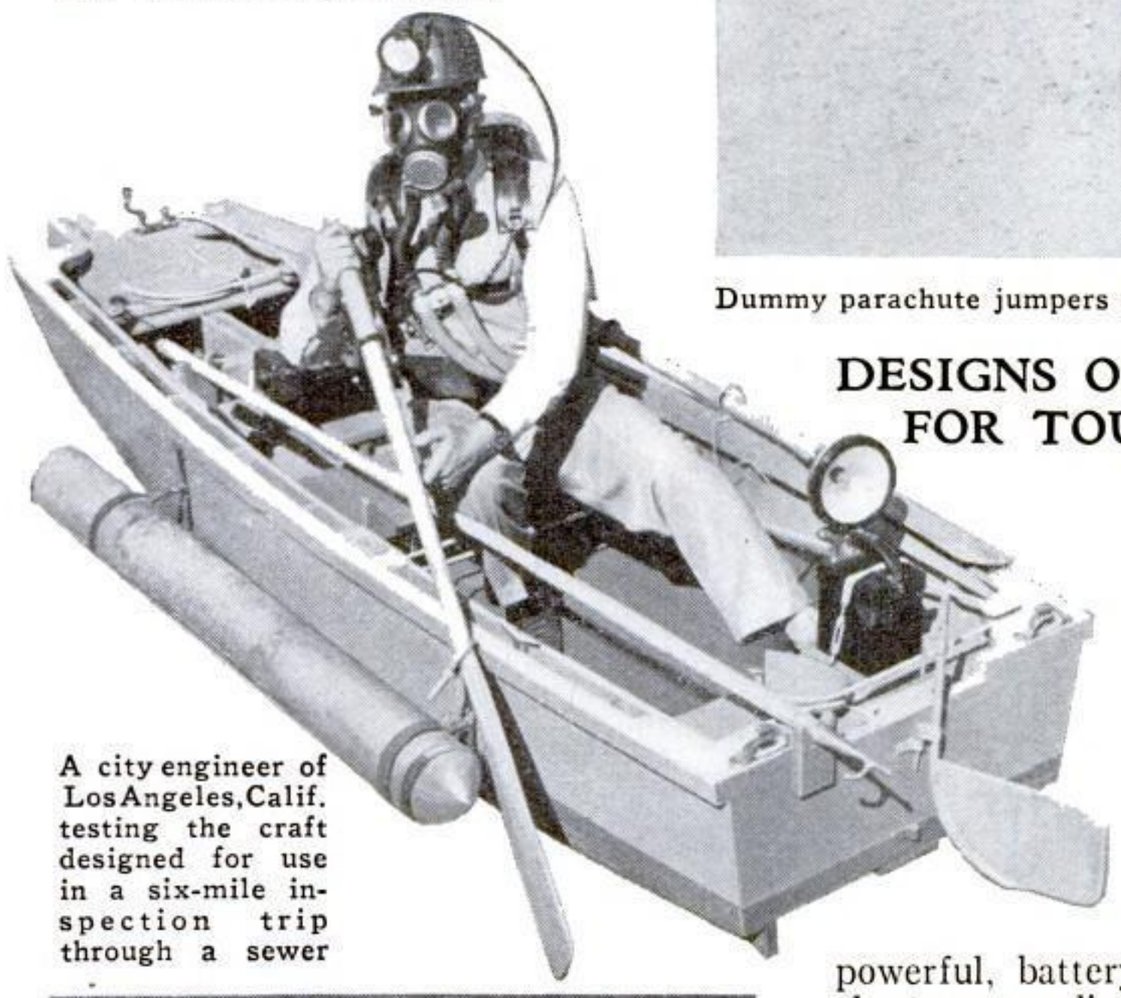


One of the newest movie cameras on location. Note streamline effect given by the camera housing

SANDBAG DUMMIES DOUBLE FOR FLYERS IN 'CHUTE JUMPS

WEIGHTED with sand and clothed in discarded flying suits, old shoes, and leather helmets, dummies made to resemble airplane pilots look like gruesome war casualties as they slump against the wall in the picture shown at the right. Nicknamed "Sandbag Squadron Leaders" by the pilots of the British Royal Air Force, the dummies were used for parachute jumps in recent aerial maneuvers at Henlow Aerodrome, England.

Dummy parachute jumpers awaiting their turns to "bail out" of planes in maneuvers of the Royal Air Force



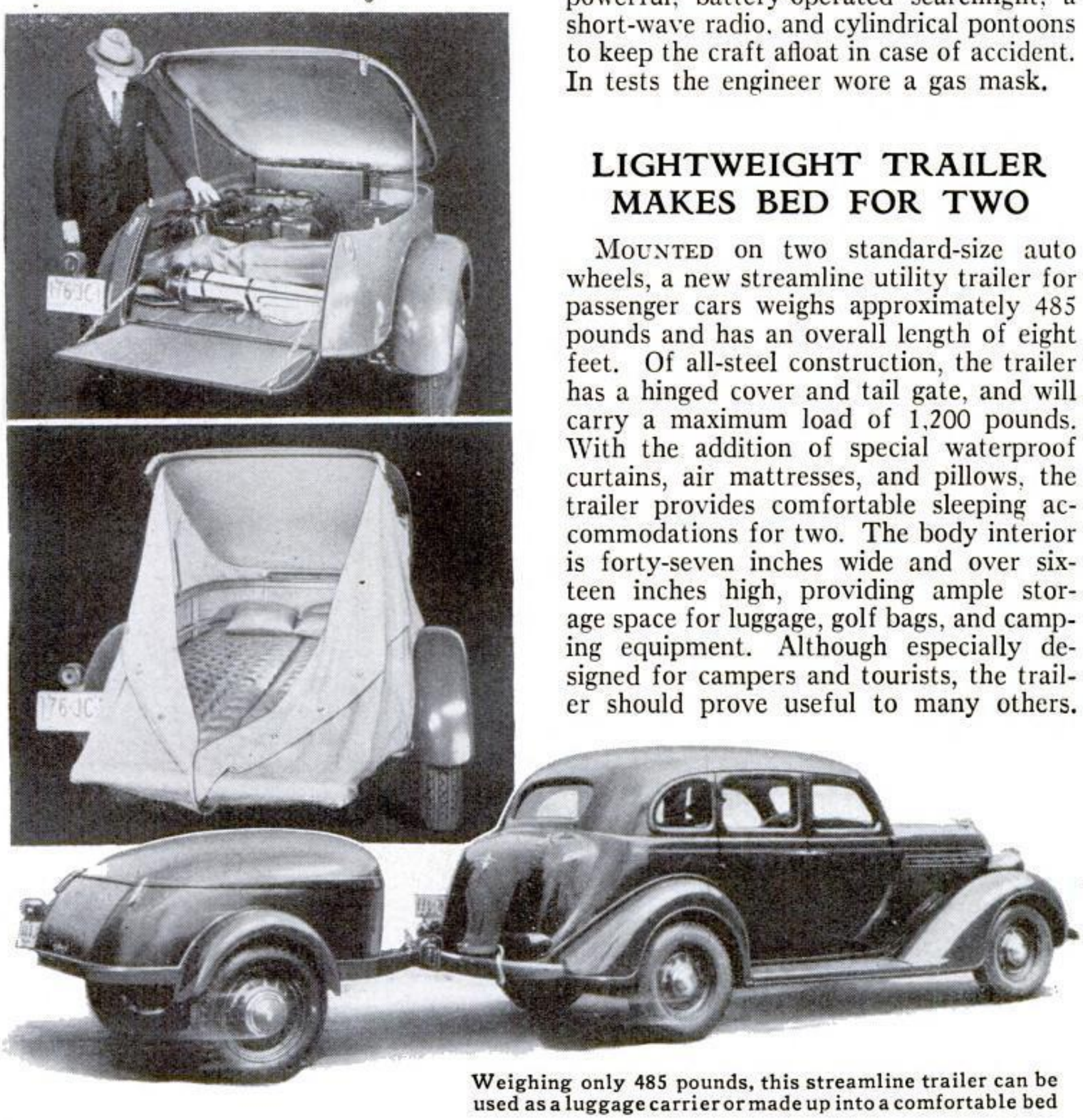
A city engineer of Los Angeles, Calif. testing the craft designed for use in a six-mile inspection trip through a sewer

DESIGNS ODD EQUIPMENT FOR TOUR OF SEWER

PLANNING to row the entire distance in a snub-nosed, flat-bottomed boat, a city engineer recently completed preparations for a strange six-mile inspection trip through a large sewer underneath the streets of Los Angeles, Calif. Equipment of the boat included a powerful, battery-operated searchlight, a short-wave radio, and cylindrical pontoons to keep the craft afloat in case of accident. In tests the engineer wore a gas mask.

LIGHTWEIGHT TRAILER MAKES BED FOR TWO

MOUNTED on two standard-size auto wheels, a new streamline utility trailer for passenger cars weighs approximately 485 pounds and has an overall length of eight feet. Of all-steel construction, the trailer has a hinged cover and tail gate, and will carry a maximum load of 1,200 pounds. With the addition of special waterproof curtains, air mattresses, and pillows, the trailer provides comfortable sleeping accommodations for two. The body interior is forty-seven inches wide and over sixteen inches high, providing ample storage space for luggage, golf bags, and camping equipment. Although especially designed for campers and tourists, the trailer should prove useful to many others.



Weighing only 485 pounds, this streamline trailer can be used as a luggage carrier or made up into a comfortable bed

SILKWORMS ARE RAISED IN A CITY HOME

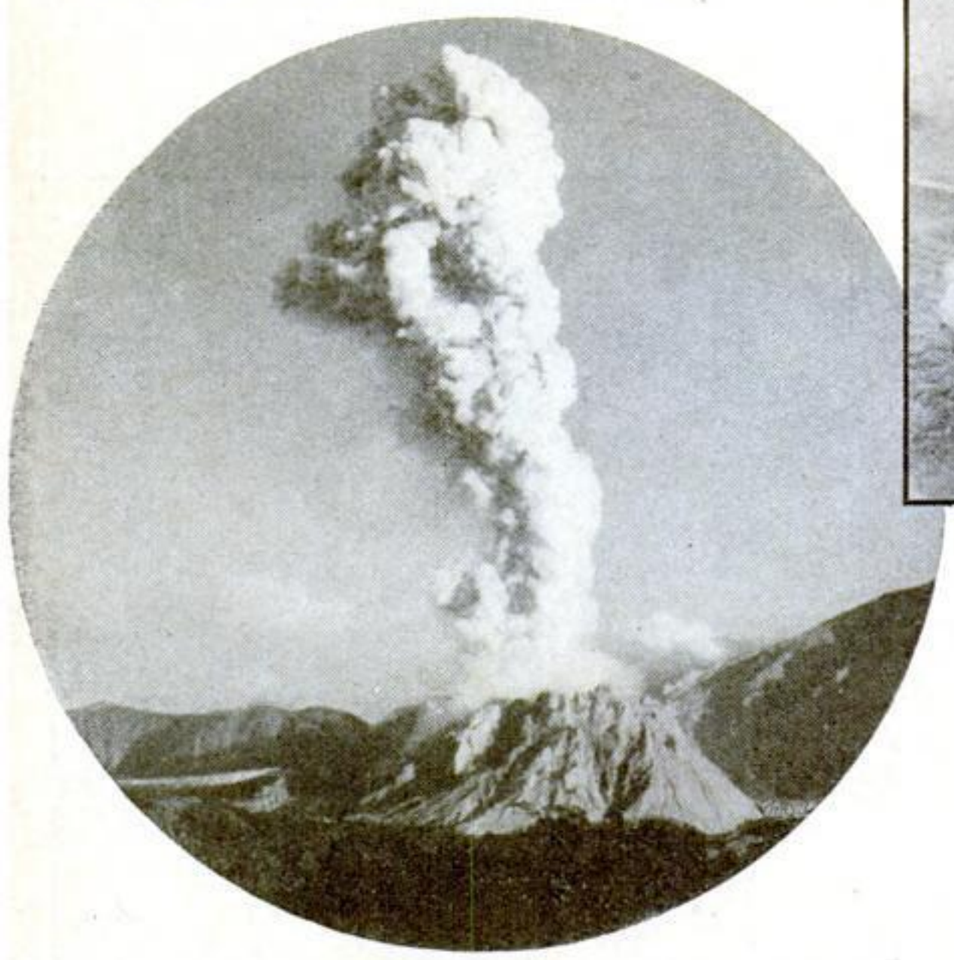
TO PROVE to agricultural leaders that silkworms can be raised successfully in this country, John Ousta, a silk expert, is cultivating thousands of the worms on mulberry leaves strewn on a table in his New York City home. The worms are said to be exceptionally healthy and to produce a high grade of raw silk. The climate of the United States is more favorable for silk production than that of Asiatic countries, states Ousta, who foresees a new $100,000,000 silk-raising industry here.

OUR SPEECH SPEEDS UP

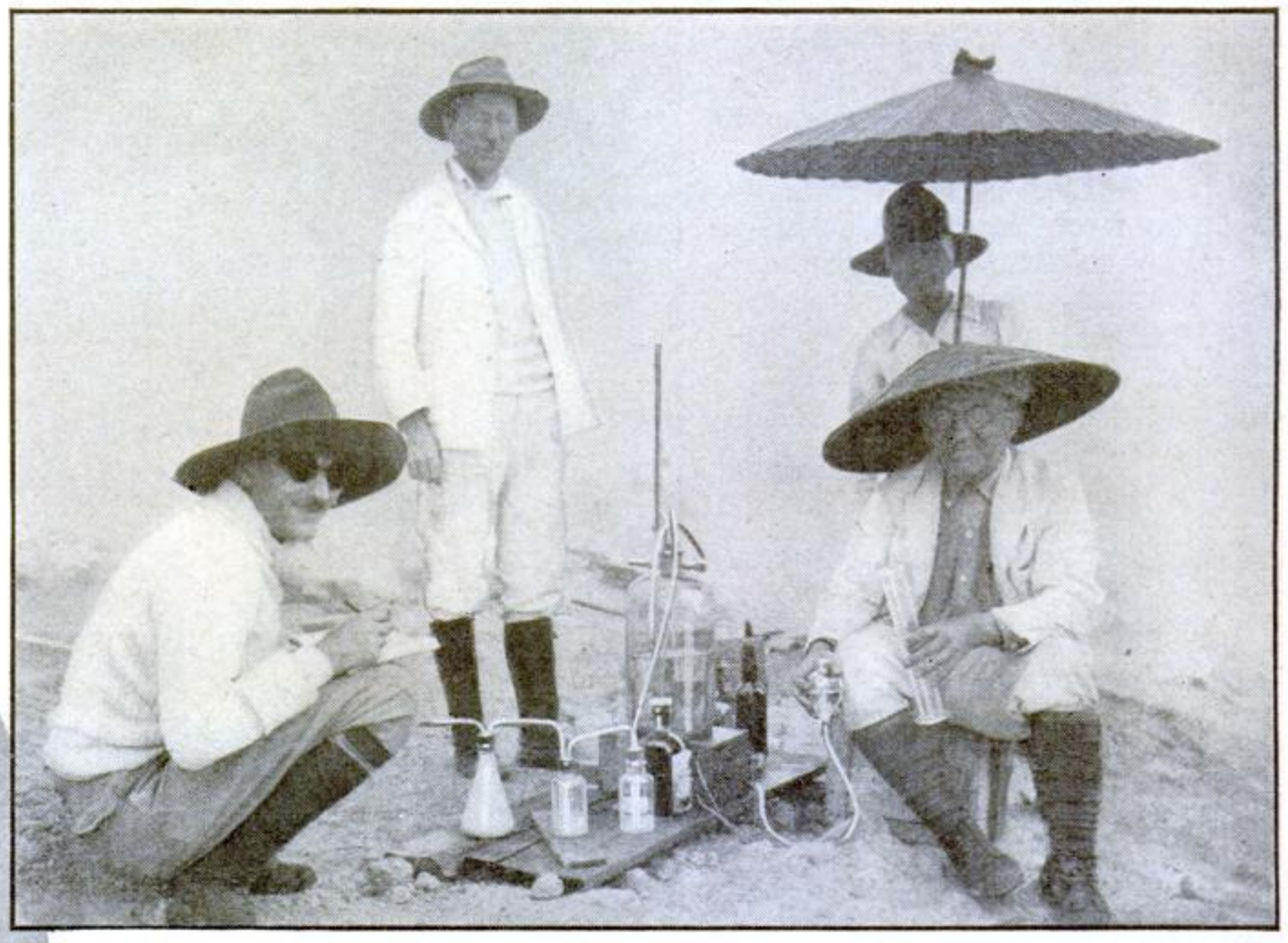
PEOPLE talk faster now than they did a few years ago, according to a recent report of the number of words taken down by official stenographers in London law courts. Although court hours and methods of procedure have not changed materially, the average number of words has increased from 30,000 a day less than a decade ago, to a total of more than 40,000 at the present time.

PORTABLE LABORATORY USED TO TEST VOLCANIC GASES

VOLCANIC GASES spouting from craters and mountainside smoke holes are being collected and studied by scientific expeditions to reveal the secrets of the mighty forces that lie deep in the interior of the earth. Flexible tubes lowered over the brim of a seething mountain crater tap samples of the gaseous smoke, which are analyzed in temporary laboratories set up on the slopes of the volcano. In expeditions to Central America and the East Indies, scientists, whenever possible, entered the craters to make first-hand observations.



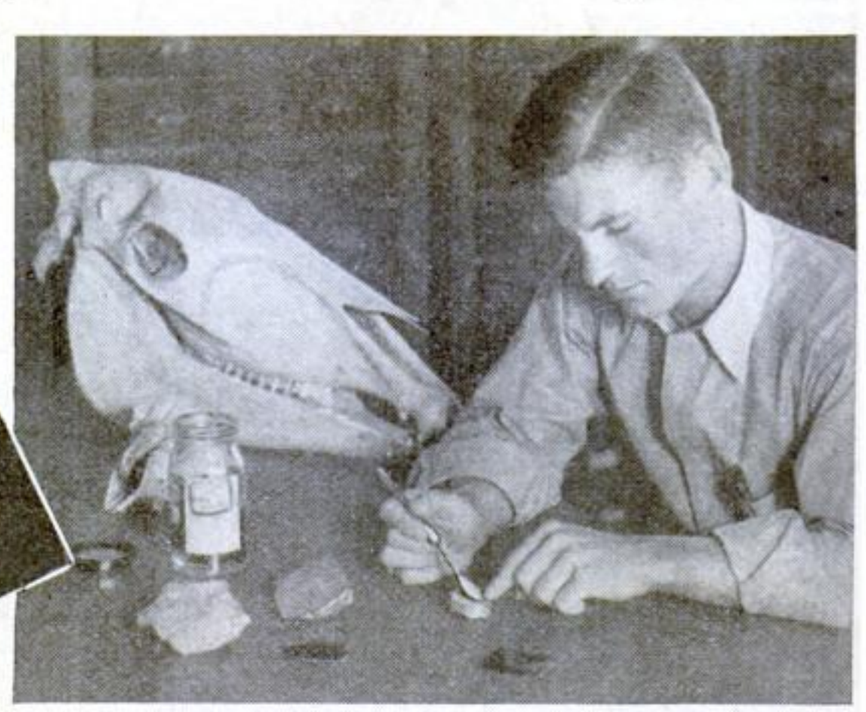
A Central American volcano visited by the testing party



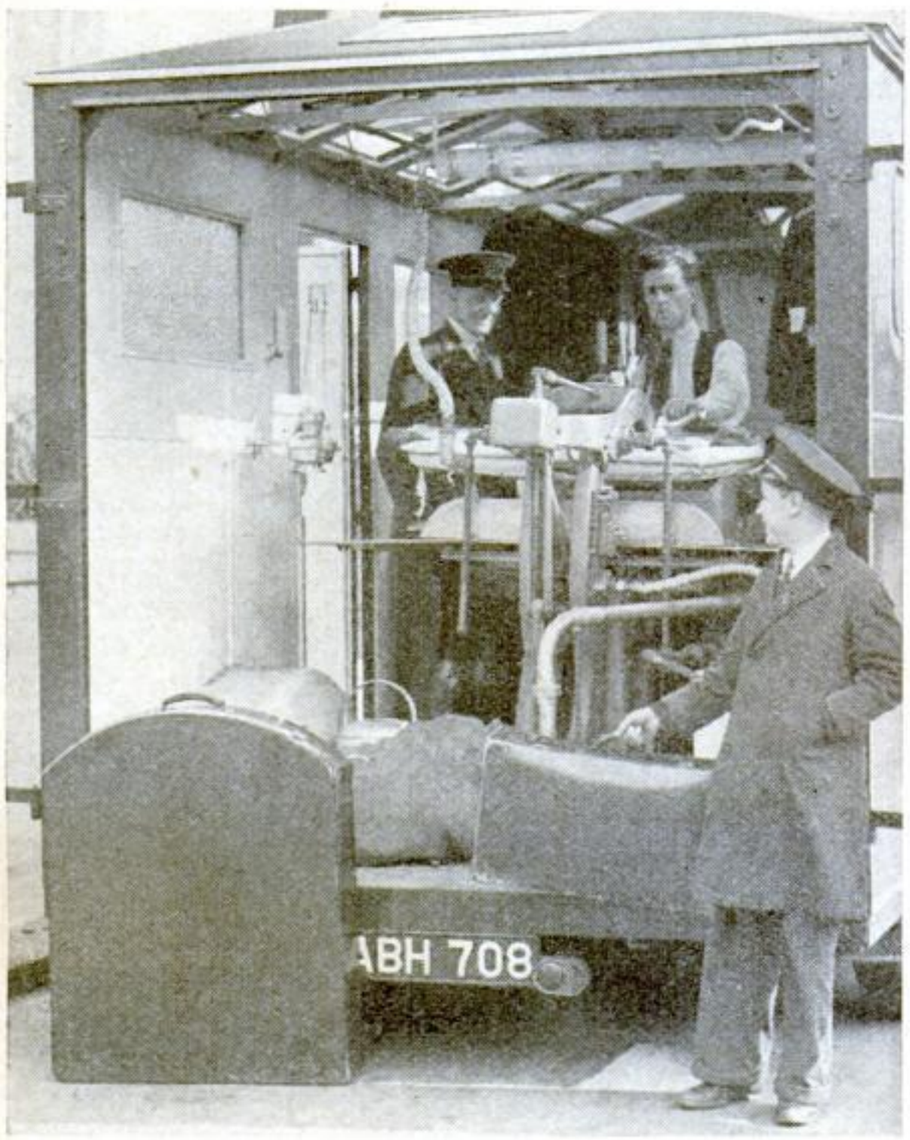
Scientists on the slopes of Papandayang, a volcano in Java, with their portable equipment set up to collect and test the various gases coming from a smoke hole

PHOTOGRAPHS FOSSILS WITHOUT A CAMERA

FOSSILS are photographed without a camera by a process in use at the Texas Technological College at Lubbock, Tex. After a thorough polishing, the fossil is bathed in weak hydrochloric acid, which etches the fossil structure into its rock base. The etched grooves are filled with a carbon-black mixture, and the surface covered with a solution containing guncotton. When dry, this coating is peeled off and used as a photographic negative. The process results in a clear picture of the fossil structure outlined in sharp, white lines on a black background.

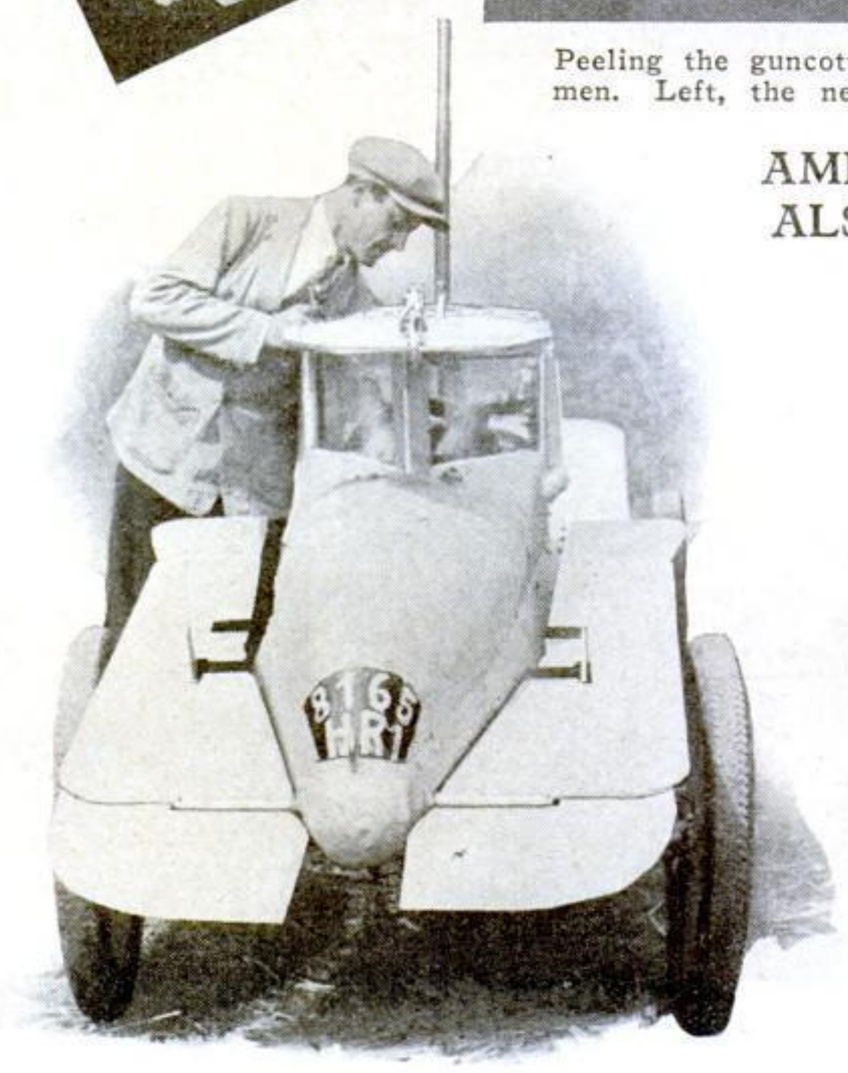


Peeling the guncotton film from a fossil specimen. Left, the negative and a positive print



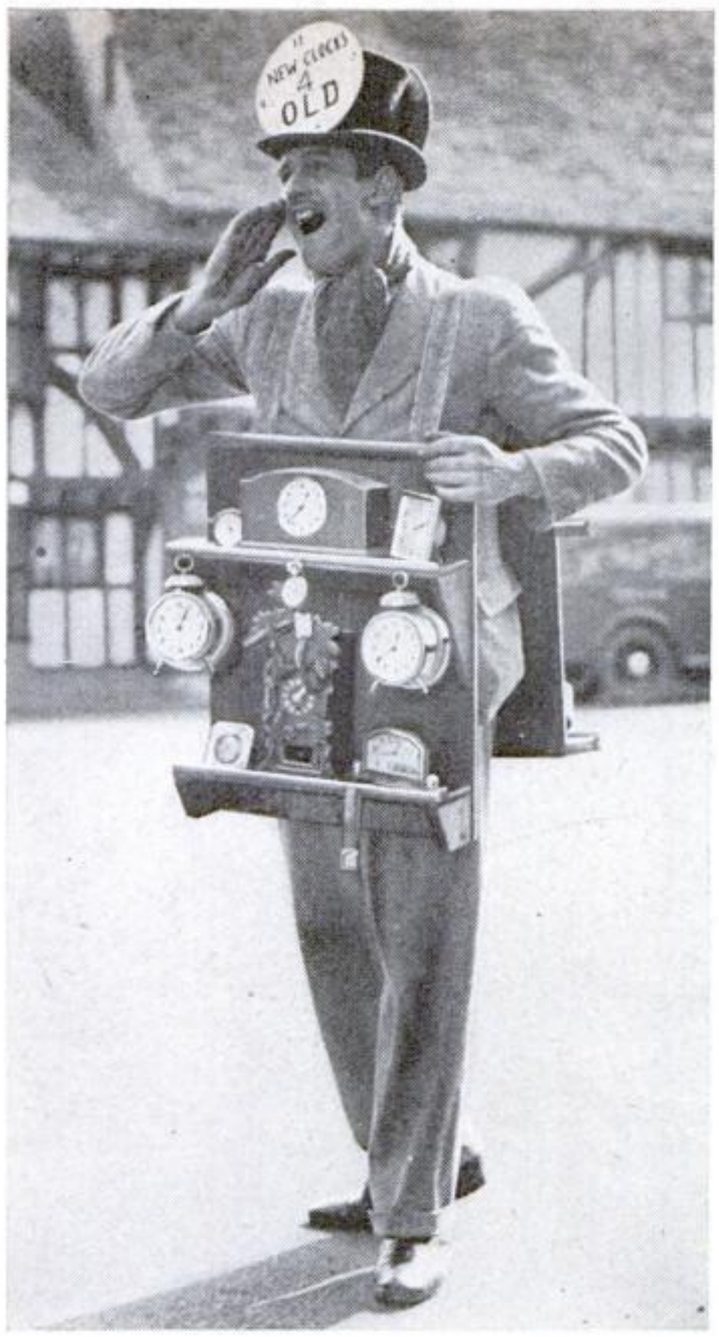
TRUCK CARRIES A TAILOR SHOP

TAILOR shops on wheels now travel about the city and suburbs of London, England, bringing valet service direct to the customer. The large, six-wheeled trucks are equipped with modern dry-cleaning apparatus and generate their own steam for their pressing machines. Clothes are collected by an attendant at the customer's door, taken to the mobile tailor shop parked at the curb, and quickly returned, cleaned and pressed, to the owner.



AMPHIBIAN AUTO IS ALSO A SUBMARINE

POWERED by a four-horsepower engine, a vehicle recently constructed by a French inventor combines the features of an automobile, a motor boat, and a submarine. The amphibian craft is said to attain a speed of twenty-five miles an hour on land, nine miles an hour on the water, and six miles an hour when submerged. All vertical underwater movements are controlled by fins operated from the water-tight cabin. Fresh air is sucked in through an air tube extending above the surface of the water.

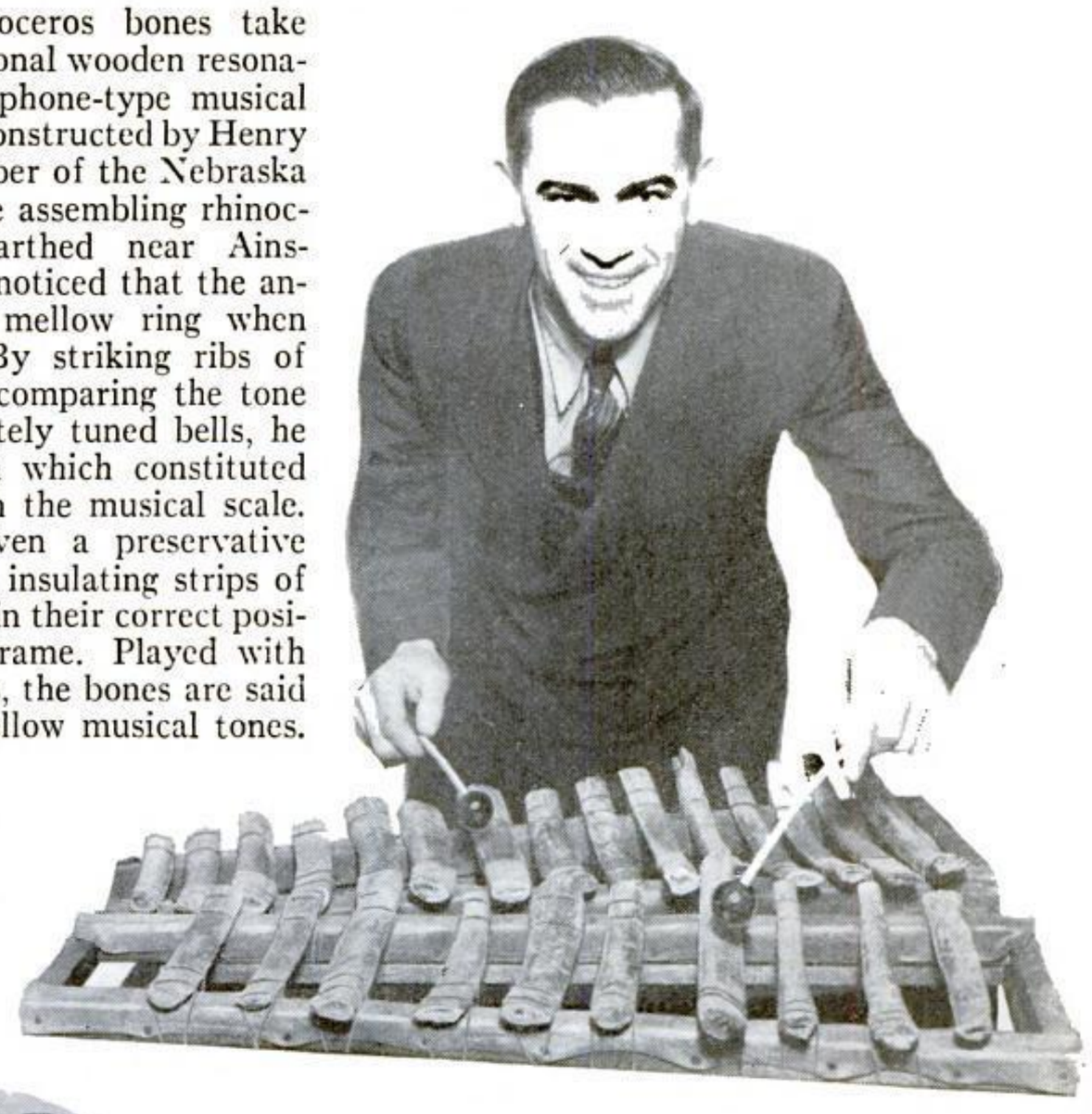


WALKING CLOCK STORE TOURS ENGLISH TOWNS

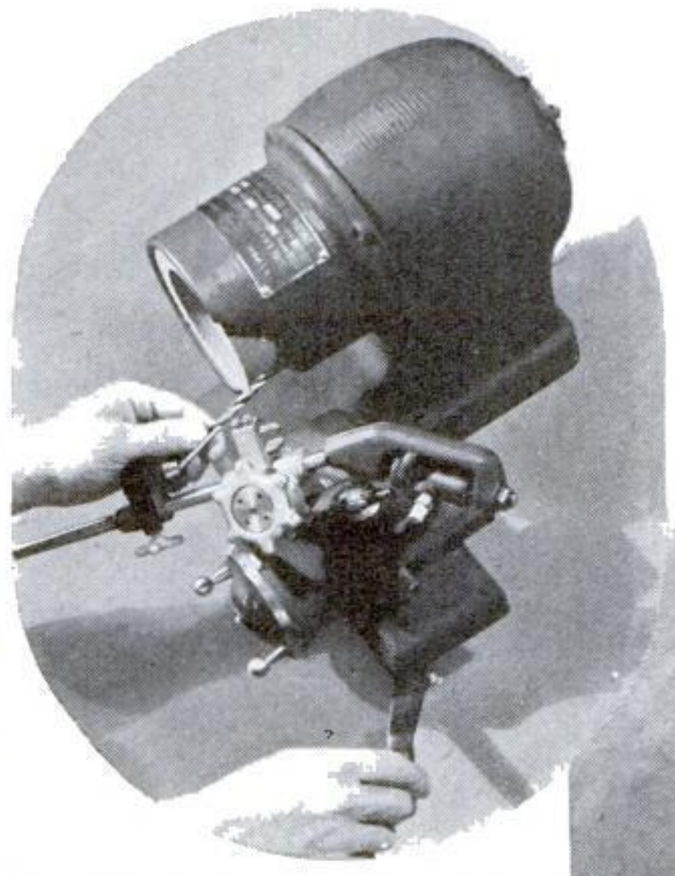
WITH two wooden display counters hanging on straps in sandwich-board style from his shoulders, the picturesque British peddler shown in the picture above tours the English countryside as a walking clock shop. Advertising placards, made from old clock dials and attached to his hat, proclaim that he is willing to trade his stock of twelve new clocks for old ones —provided, of course, that the purchaser agrees to add an acceptable sum of cash to the trade-in value of the old timepiece. This "sign of the times" strikes a modern note in quaint old English villages.

GETS MUSIC FROM PREHISTORIC BONES

PREHISTORIC rhinoceros bones take the place of conventional wooden resonators in a novel xylophone-type musical instrument recently constructed by Henry P. Reider, staff member of the Nebraska State Museum. While assembling rhinoceros skeletons unearthed near Ainsworth, Neb., Reider noticed that the ancient bones had a mellow ring when knocked together. By striking ribs of various lengths and comparing the tone with a set of accurately tuned bells, he built up a collection which constituted two whole octaves in the musical scale. The bones were given a preservative treatment, placed on insulating strips of rubber, and fastened in their correct positions to a wooden frame. Played with small wooden mallets, the bones are said to give clear and mellow musical tones.



Henry P. Reider, of the Nebraska State Museum, playing on the musical instrument he made from old rhinoceros bones

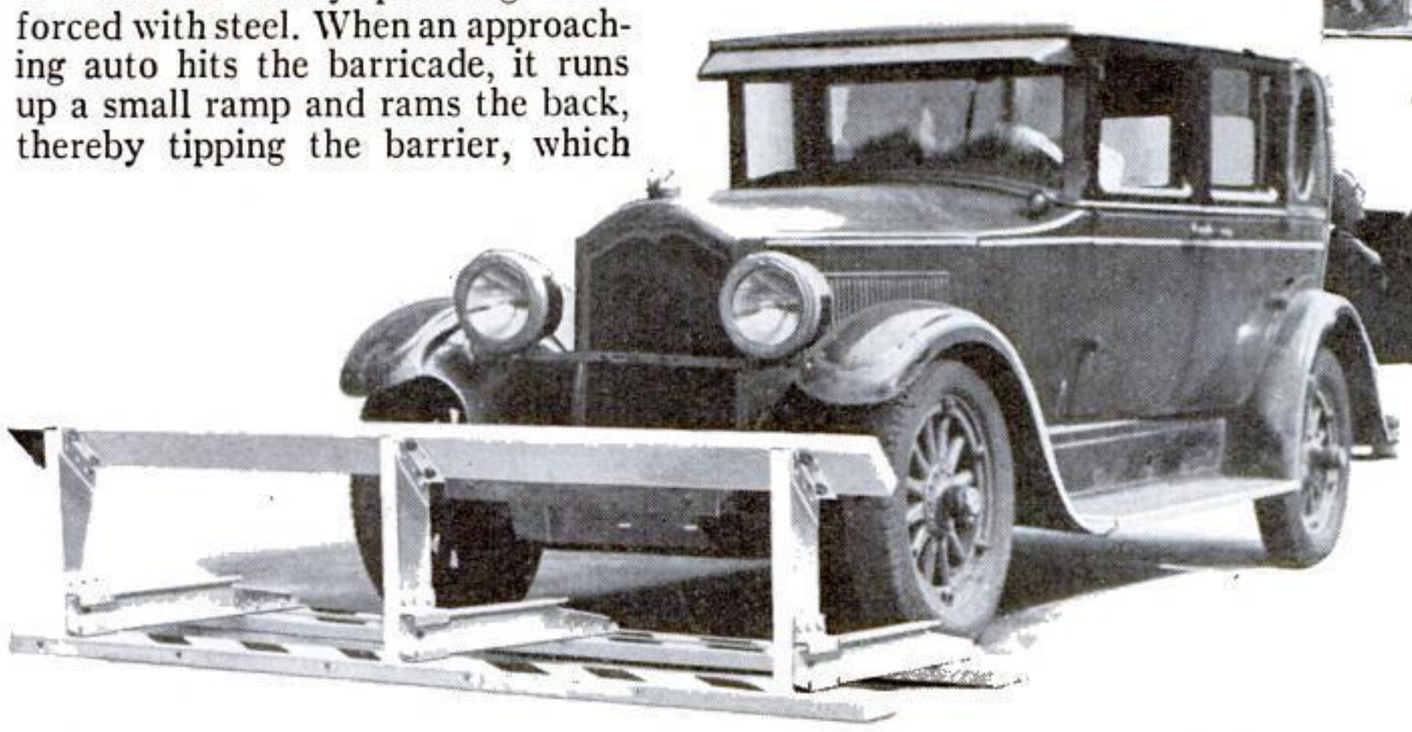


GRINDS DRILLS UNIFORMLY

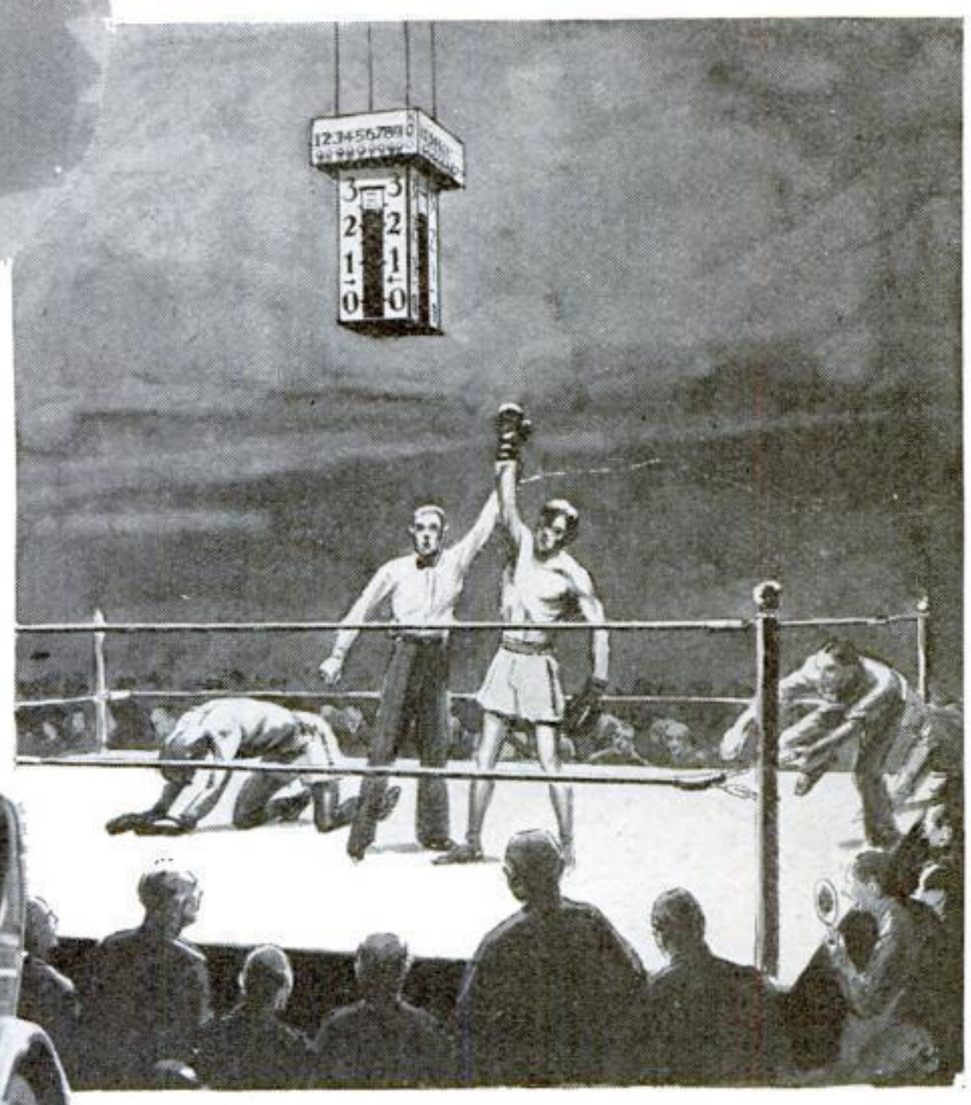
TWIST DRILLS are sharpened with great precision by a new type of grinder. The drill, after being securely clamped in a chuck, is automatically guided back and forth against an electrically driven grinding wheel. Since the drill is free during the grinding, the sharpened lips are identical in respect to length and clearance.

NOVEL BARRIER GUARDS STREET WORKMEN

BECAUSE a number of workmen repairing gas mains in the streets of Chicago, Ill., have been injured recently by automobiles, a new type of safety barricade has been constructed to supplement warning signs. The L-shaped protective fence is made of heavy planking reënforced with steel. When an approaching auto hits the barricade, it runs up a small ramp and rams the back, thereby tipping the barrier, which jams under the car and lifts its back end clear of the ground. The device, it is claimed, will stop an automobile going twenty miles an hour within six feet.



When a car strikes this barrier, the platform tips up to raise the rear wheels



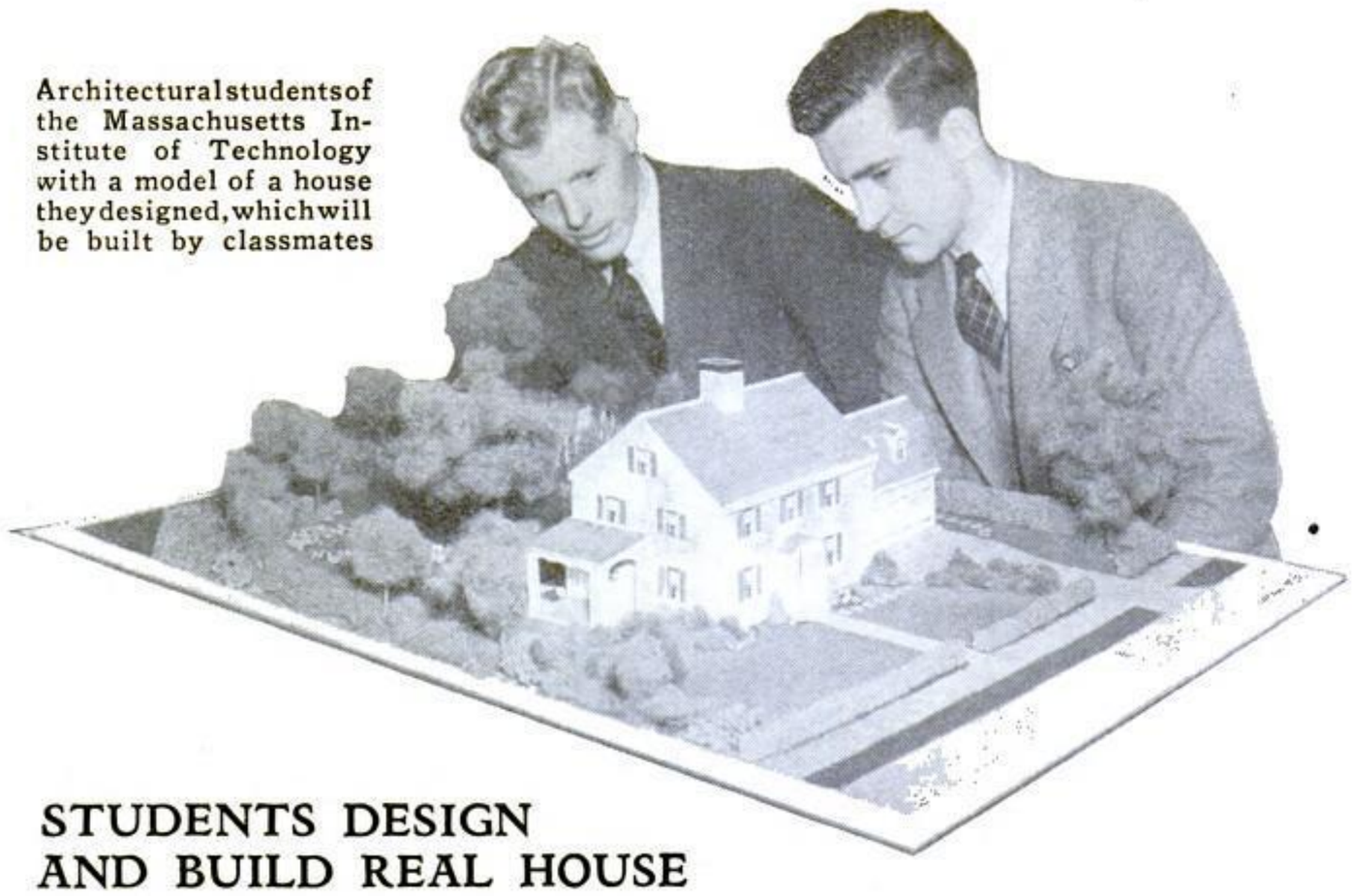
TIMER FOR BOXING BOUTS

BOXING BOUTS are scientifically conducted by a new mechanical timing device. Mounted prominently above the ring, the mechanism times each round and automatically sounds the opening and closing gongs. Numbered lights flash on to indicate seconds and a loudspeaker announces the knockdown count. A moving shadow on a scale shows the time remaining in each round.

Barbara, one of the polar bears at the zoo in London, England, photographed through the wall of her swimming tank

ODD VIEW SHOWS POLAR BEAR IN THE ROLE OF A DIVER

CAUGHT by the camera as she dived to the floor of her pool and stretched out her neck for a dainty morsel of food, Barbara, prize polar bear at the zoo in London, England, presents a strange appearance in the photograph reproduced above. The odd shot was snapped through the thick glass windows of her swimming tank.



Architectural students of the Massachusetts Institute of Technology with a model of a house they designed, which will be built by classmates

STUDENTS DESIGN AND BUILD REAL HOUSE

SUPPLEMENTING their classroom studies, two architectural students at the Massachusetts Institute of Technology, Cambridge, Mass., designed an attractive colonial dwelling, a model of which is illustrated. The entire architectural class has now selected and negotiated the purchase of a suitable building plot, and will superintend the construction of the house under actual conditions of architectural practice. When completed, the house will be sold to finance a like project for the next class.

PARTY GUESTS EAT THEIR PLATES

PLATES, cups, and saucers made of clear sugar candy have recently been marketed as a novelty for parties and social entertainments. After refreshments have been served, guests can eat their dishes as an extra dessert. While still hot and in a liquid state, the cooked sugar confection of which the dishes are made, is poured into patterned molds where it hardens into edible forms resembling real glass or crystal. If the guests are still hungry, they may eat the cutlery for that, too, is made of the same confection. Eating the dishes and cutlery solves the dish-washing problem for the hostess.

Dish washing is no problem after a party at which these edible candy dishes are employed

WORLD'S BIGGEST ENLARGEMENT

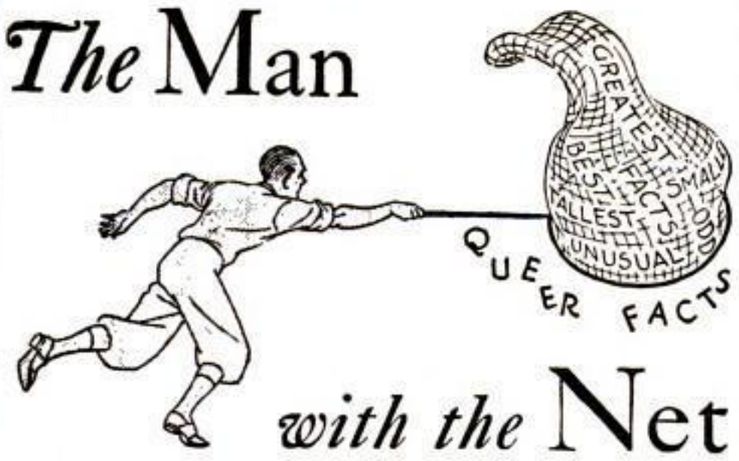
WHAT is believed to be the biggest single-step enlargement of a photograph ever made, was exhibited recently by Ivan Dmitri, prominent photographer. The unretouched enlargement, showing a herd of wild horses, is over eleven feet long and forty inches high, and was made in one step from the tiny section of negative, only three eighths by one and three eighths inches, shown in the circle.

REFLECTOR SAFETY BELT

Reflector buttons on this belt protect pedestrians at night

PEDESTRIANS walking at night along the sides of unlighted roads are protected by a new safety belt which reflects the headlight rays of oncoming cars. Worn over one shoulder like a sling, the leather strap is studded with small reflector buttons, whose gleam is visible for 1,000 feet.

The Man



with the Net

GOATS *raised in the United States for their milk now number more than 5,000,000.*

RAIN *falls within the Washington Monument on warm days after cool spells.*

LIZARDS *of a species found in Egypt never drink. They get their water supply by absorbing dew through their skin.*

INSURANCE *against broken eyeglasses is now furnished by a London insurance company.*

HUMAN HAIR *forms the cloth through which cottonseed oil for cooking purposes is pressed. It withstands a pressure of six tons to the square inch.*

POCKET-SIZE SUNDIALS *are carried in some parts of China as timepieces.*

THE AVERAGE AGE *of all the Presidents at death, from Washington to Coolidge, is 68.4 years.*

BULLSNAKE YOUNG *are halfway formed in the eggs at the time the mother snake lays them.*

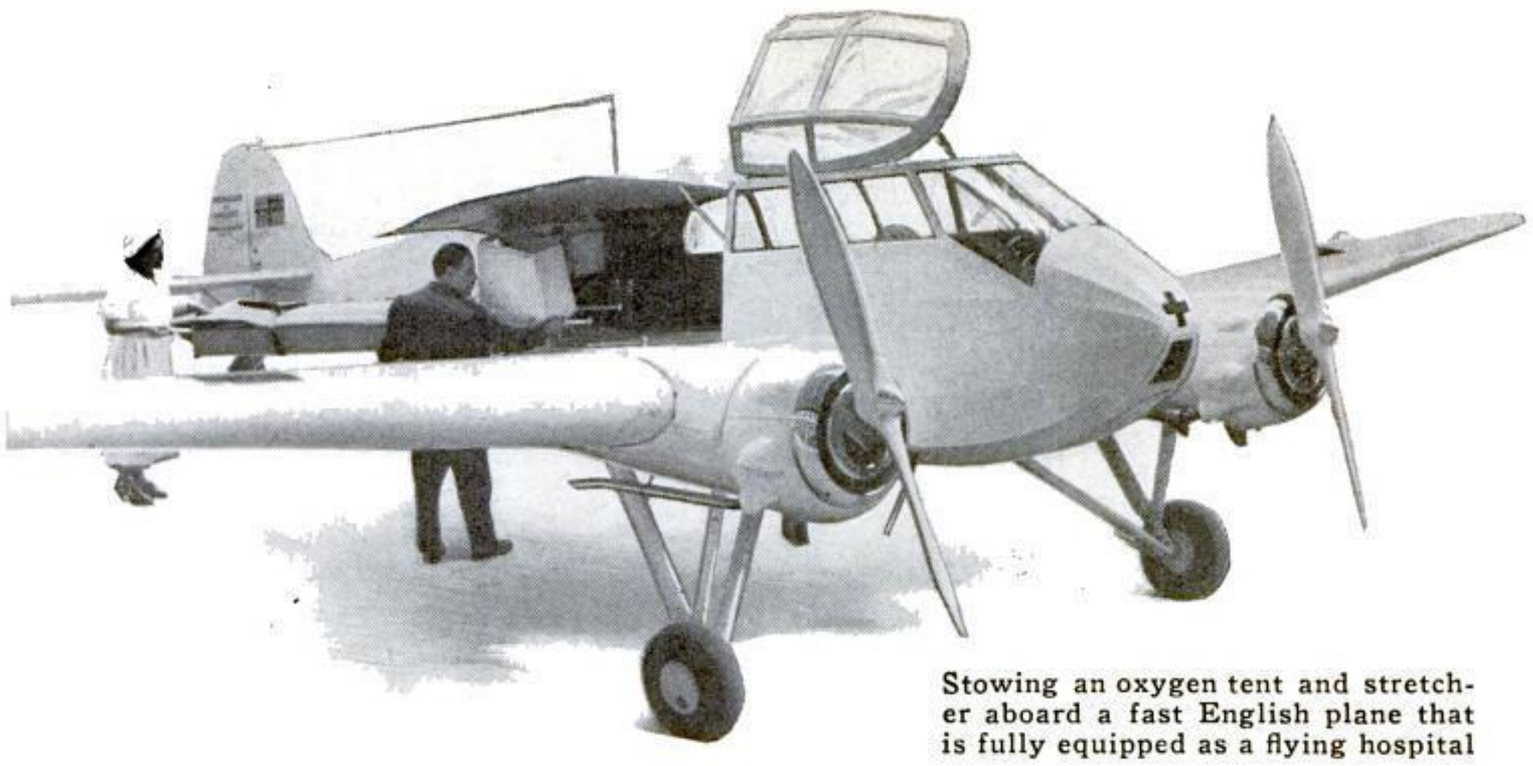
NO WHEELED VEHICLES *are used in Tibet.*

WOLVES *do not travel in packs.*

COLOR-BLINDNESS *is ten times more prevalent among men than among women.*

ANABAS—*fish adapted to air breathing—are brought to market in Siam alive in wicker baskets. Occasional sprinkling with water keeps them alive until sold.*

GANNETS, *sea birds that dive into the water from heights of sixty to 100 feet, have been caught in fishermen's nets at a depth of ninety feet under the surface.*



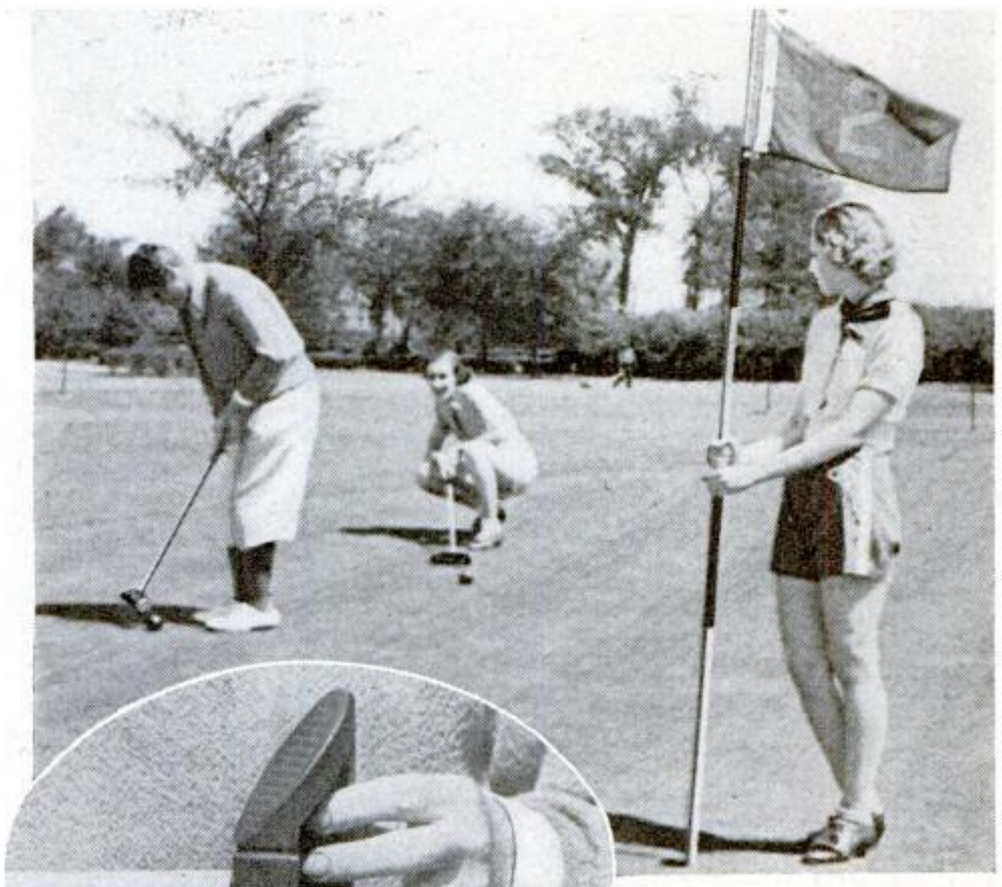
Stowing an oxygen tent and stretcher aboard a fast English plane that is fully equipped as a flying hospital

PLANE IS COMPLETE FLYING HOSPITAL

To PROVIDE adequate treatment while flying emergency cases to medical centers or base hospitals, an all-white, speedy hospital plane has just been completed at Hanworth Airport near London, England. Driven by two ninety-five-horsepower engines, the unique flying hospital is completely outfitted with the most modern medical and nursing equipment, including oxygen and blood-transfusion apparatus.

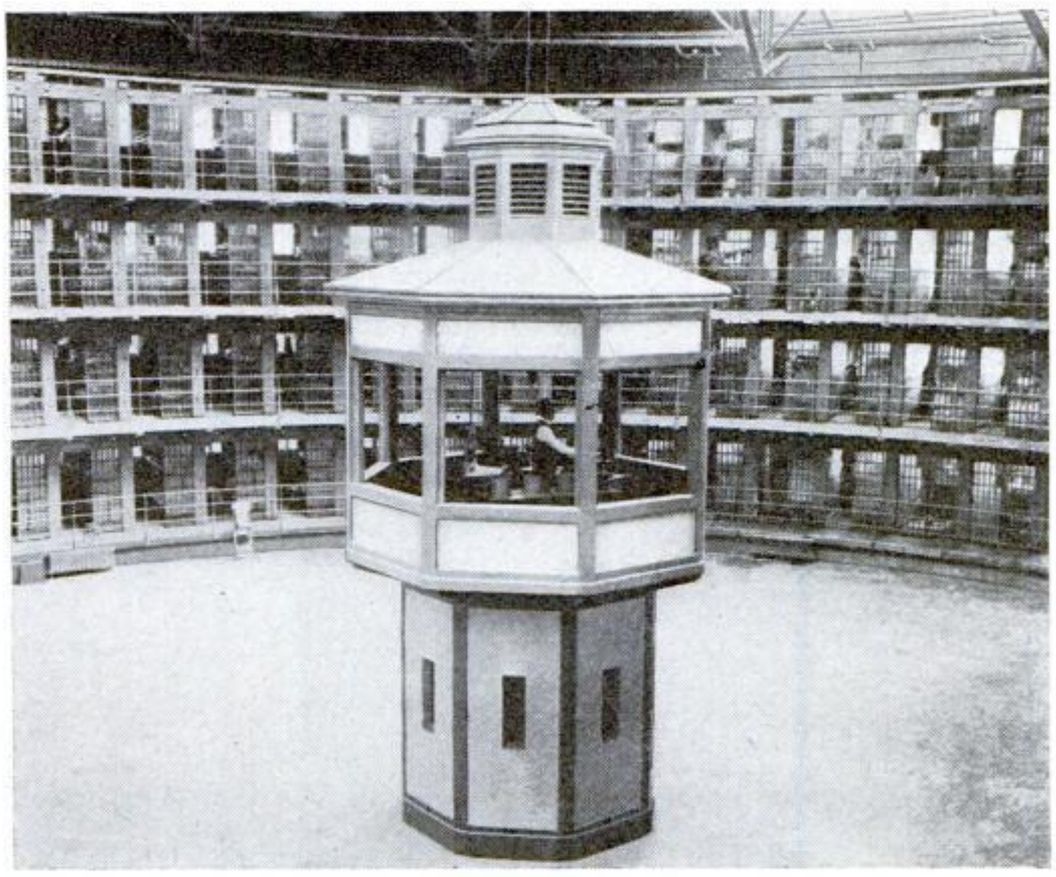
NOVEL GAME COMBINES GOLF AND POLO

POLO PLAYERS may have the advantage over golfers in a new and novel game called "polo golf." Although no ponies are used and the scoring, and rules are the same as in golf, all shots in the game are made with a single club that has double-ended, composition-rubber head resembling a polo mallet. One end of the head is flat and is used for both putting and driving, while the opposite end is slanted at an angle for hitting the ball over obstacles, and for short approach shots. The ball is about the size of a polo ball, but much skill is required in making "shots."



A scene on the green in a game of "polo golf." A single club with double head, shown at left, is used for all strokes

ONE MAN GUARDS CIRCULAR CELL BLOCK



The tower guard controls all doors and lights in this circular prison

INMATES of the model state prison at Statesville, Ill., are housed in four tiers of cells constructed in a wide circle. Each of the four huge circular cell blocks in the prison can be guarded by one man. Stationed in a central control tower at the hub of each block, the guard has an unobstructed view into every cell. Electric controls in the tower enable the guard to switch off all lights and to lock or unlock individually any cell in the circular block under his supervision. (See also page 11.)

Flying

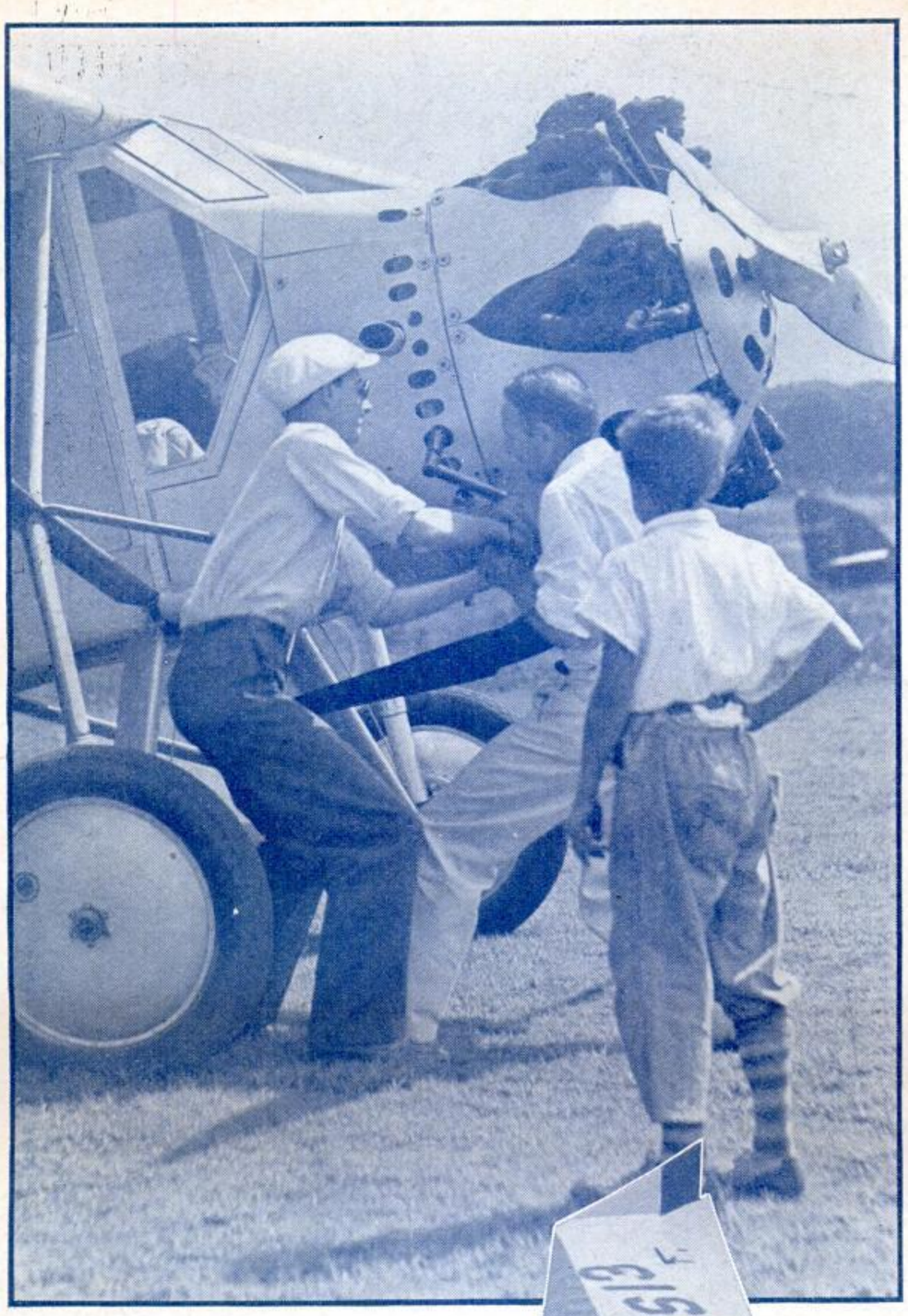
MORE than half of the airplanes produced in this country are being sold to private flyers. Tucked away in the latest aviation statistics, that significant fact reflects a remarkable trend in American aviation. Amateur pilots are stealing the show from professionals. They are rapidly becoming the most important group, in point of numbers, flying today.

When the U. S. Department of Commerce first took over the task of registering airplanes, just ten years ago, barely five percent of them were used outside the aviation business. Flying, except in the course of regular air-mail or passenger-transport operations, was popularly regarded as a pastime for reckless young dare-devils. Today, private airplanes rank in number with professionally operated craft, and their proportion is steadily mounting. Nearly 7,000 amateur pilots are using airplanes as casually as most people use automobiles. Their ranks include millionaires and auto mechanics; debutantes and waitresses; doctors, lawyers, bankers, farmers, big-game hunters, explorers, fishermen, prospectors—the list might go on indefinitely.

What is the story behind the activities of these private pilots? Why do they fly? How would you go about following their example? Has flying become, by now, a pursuit for the average man? The answers to questions like these, I found, reveal the amazing strides that popular aviation has been making in recent years.

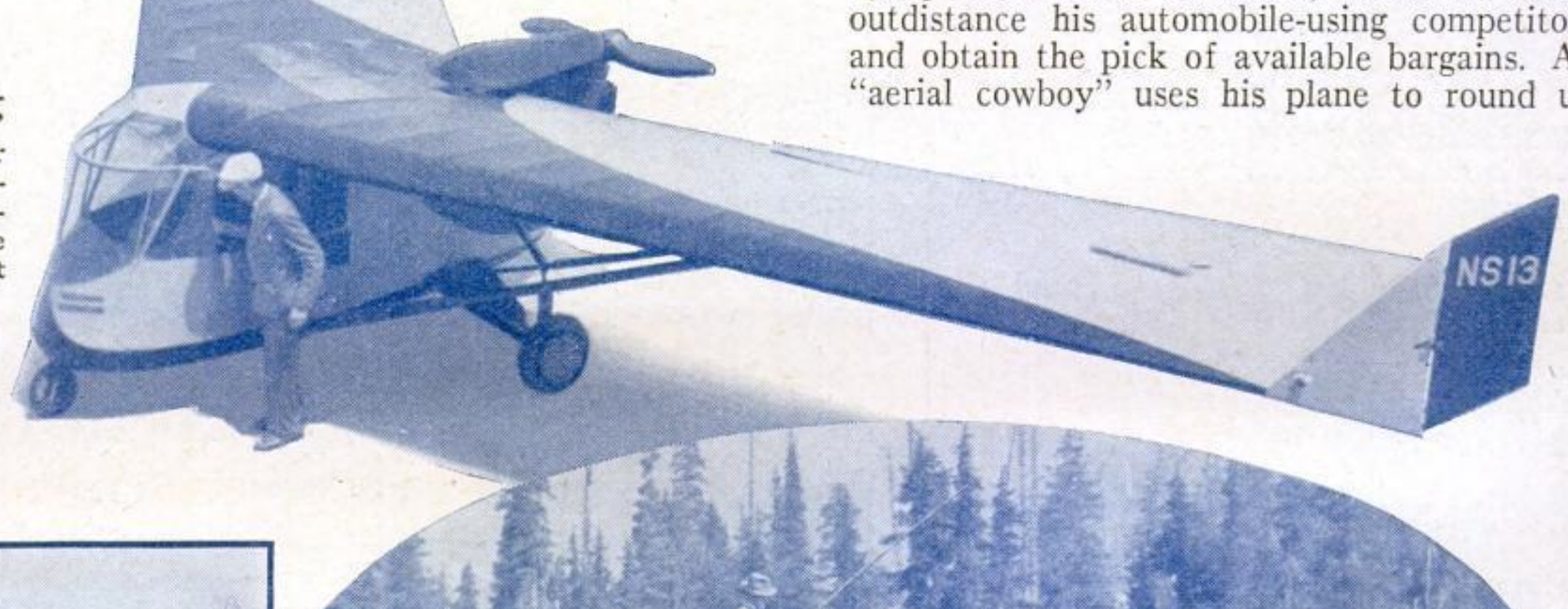
Conservative, middle-aged business men are finding the airplane as essential an aid as the automobile. Manufacturers are training their star salesmen as pilots and providing them with planes so that they can cover more territory and interview more prospects in a given time. Enterprising individuals are becoming airmen to further their personal business undertakings.

A salesman for washing machines obtained 1,600 orders on a single trip by air. A buyer of cattle and sheep, flying from ranch to ranch, found he could outdistance his automobile-using competitors and obtain the pick of available bargains. An "aerial cowboy" uses his plane to round up

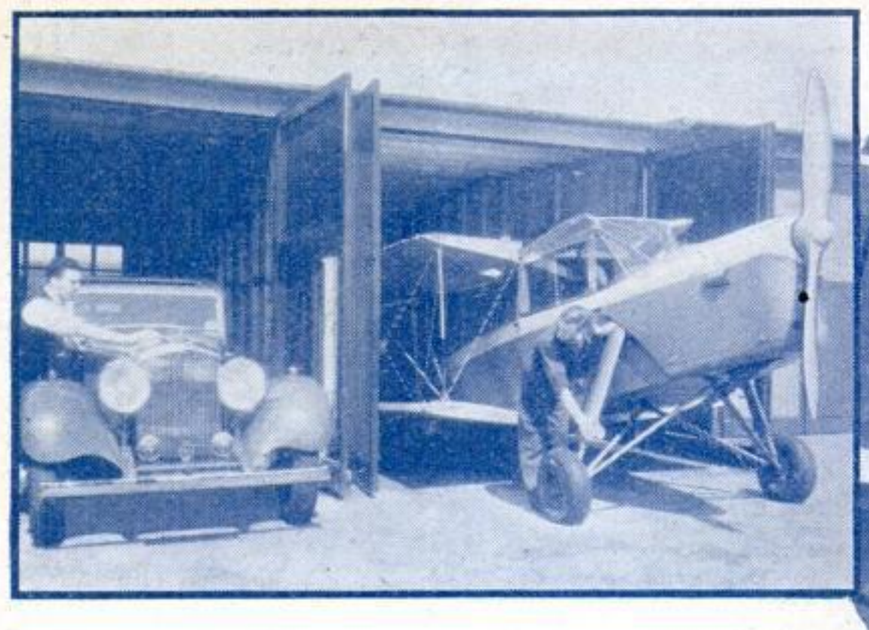


Amateur aviators preparing to take off for a cross-country tour from New York to Montreal

Waldo D. Waterman, inventor, inspecting a "foolproof" airplane he developed for the U.S. Department of Commerce as a part of its campaign to encourage private flying with low-cost craft



Below, a two-passenger "flivver plane" that can be parked in an ordinary garage. Small, economical machines like this may make airplanes as common as autos



A party of air-minded sportsmen fishing from an amphibian biplane they employed to fly to remote lakes where fish were plentiful

for Fun

This plane gives the pilot a wide field of vision. The front wheel prevents nosing over

livestock and wild game. By taking clients aloft in his plane, an advertising man engaged in selling billboard space was able to show them just where heavy traffic on the highways made outdoor advertising desirable. These examples, taken at random, give just a glimpse of the variety of business uses to which the airplane has been found adaptable.

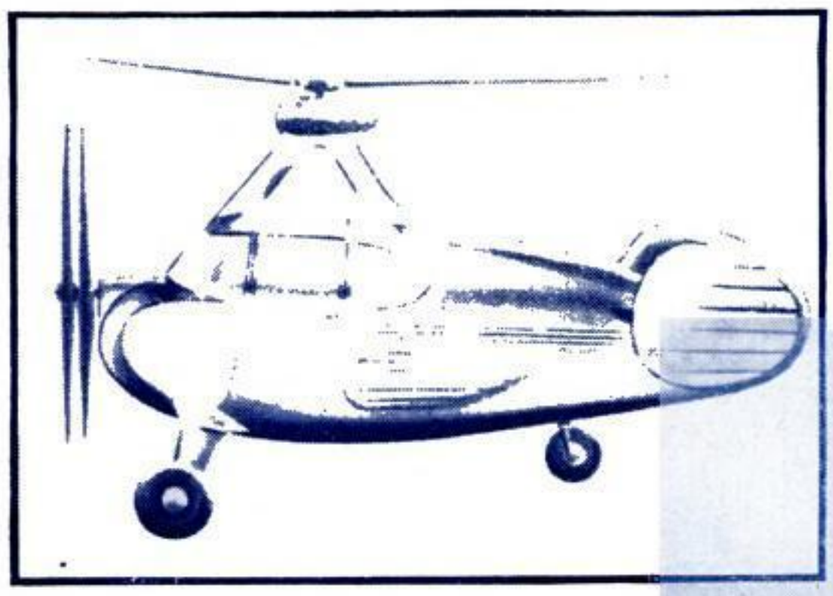
Other amateur pilots have taken up flying simply for the fun of it—and discovered that they can cover distances on week-end and vacation trips that would be out of the question by any other form of transportation. They fly to far-away mountain and seaside resorts, to fishing haunts and hunting country, to regattas and football games. Busy executives use their planes for week-end visits to distant summer homes; one New Yorker leaves his office Friday afternoon, flies to St. Johns, New Brunswick, enjoys a full week-end there, and is back in the city on Sunday night!

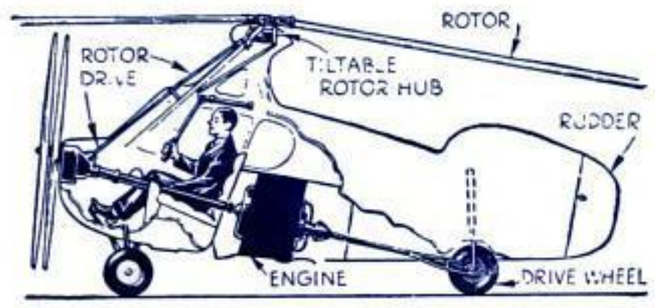
"Aviation country clubs" have sprung up for plane-using members, providing them not only with hangar space but with golf courses, tennis courts, and other recreational facilities. The pioneer organization of this kind, at Hicksville, N. Y., now boasts about 200 members. Some own their own craft; others may rent a plane from the club for fifteen to twenty dollars an hour, depending on the type of machine they choose.

Members of the Hicksville club, incidentally, have initiated a picturesque fashion among private flyers—the use of personal insignia, painted on the fuselage like the emblems of Army and Navy flying units, to decorate their craft. Some have devised symbols depicting their hobbies or business interests; others use modified yachting emblems, copies of family crests, or adaptations of the insignia of air units with which they were associated during the World War.

Air races and cross-country tours offer attractive sport for private flyers. Last year, amateur pilots participated in an air meet at Miami, Fla.; in air races at Cleveland, Ohio; and in intercollegiate air meets in which contestants vied in dropping dummy "bombs," bursting balloons, and making accurate landings within a marked space. Forty private pilots flew from New York to Montreal and back, and six Canadian planes returned the visit. Members of the Hicksville club toured the New England coast on their annual seaplane cruise.

From pilots who use their planes for business, and those who fly simply for pleasure, I heard the same story. Imagine yourself up in the air, they told me, *(Continued on page 110)*



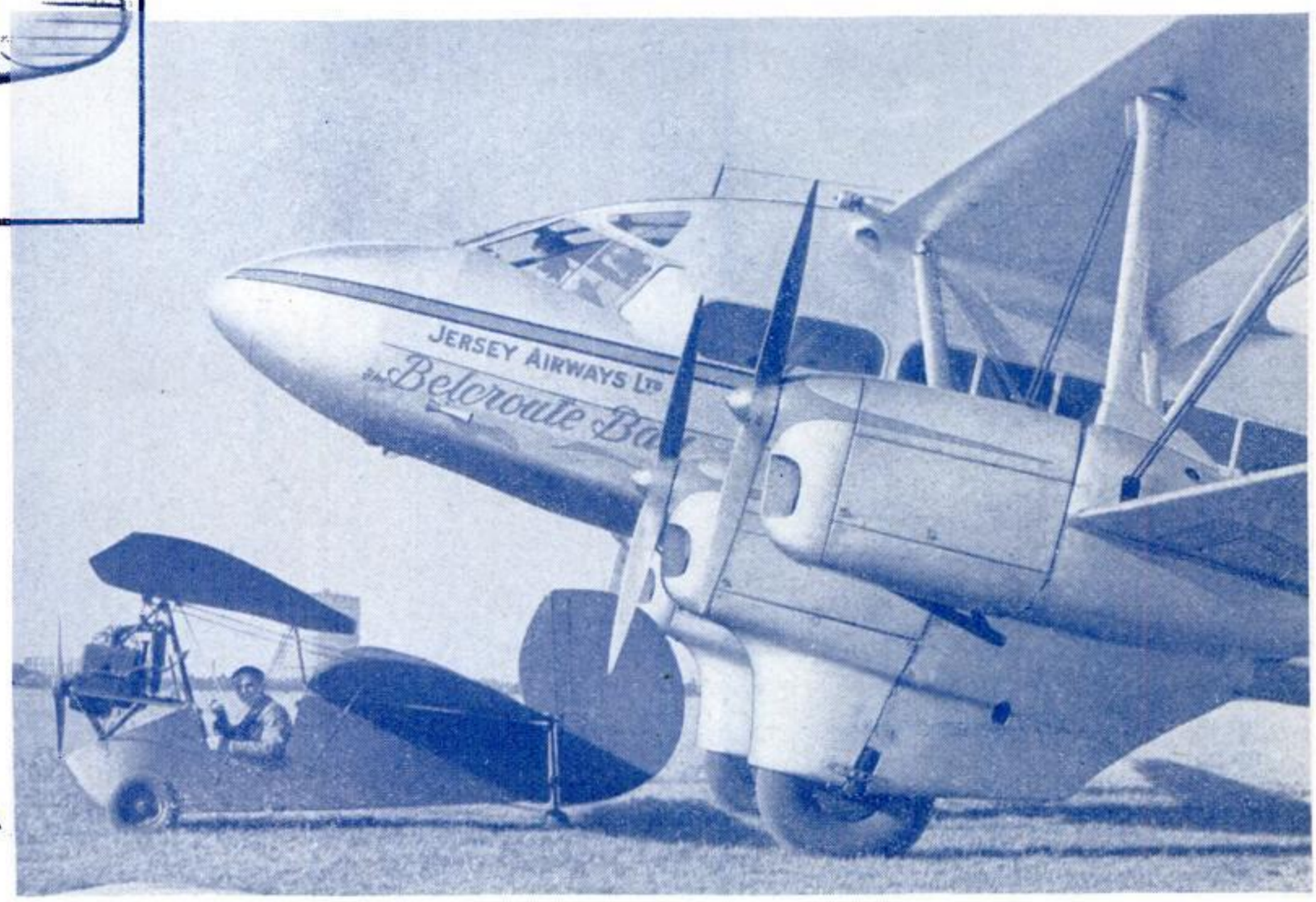


Artist's conception of a "roadable autogiro" which can fold its wings and roll along a road under its own power. The two propellers turn in opposite directions

Personal insignia, based on family crests, geometrical designs, or comic ideas, identify many private planes

Amateurs Invade the Airways as New Planes Bring Aviation Within the Reach of Everyone

By ALDEN P. ARMAGNAC



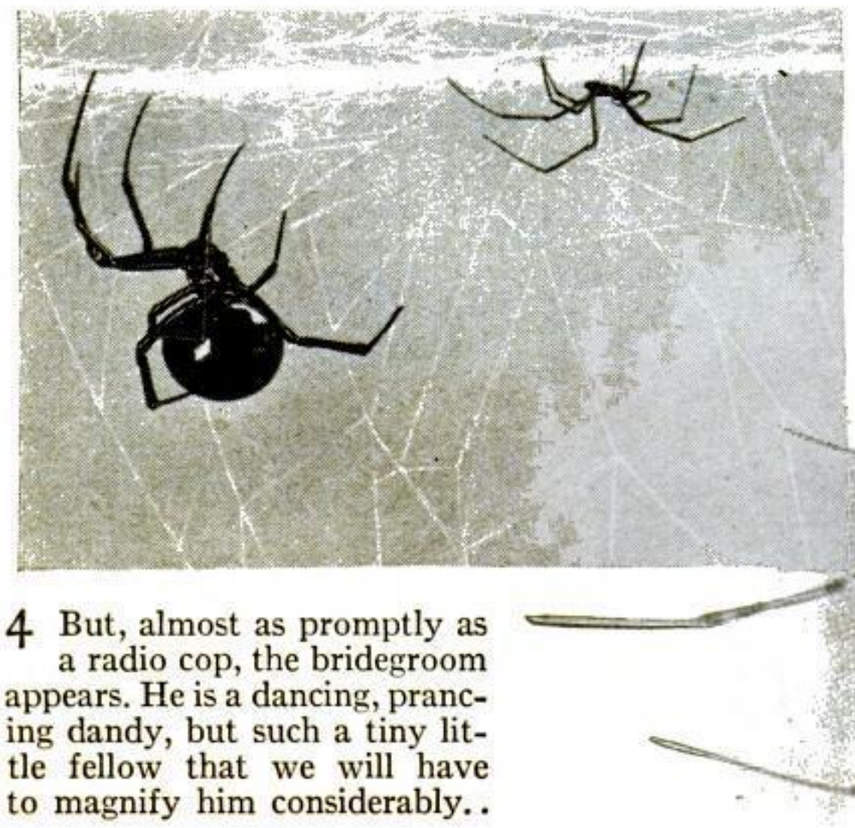
The "flying flea," shown here in contrast with a big transport plane, has become a popular feature of aviation in France. Frenchmen build these midget craft for themselves from low-priced standardized parts

Life Story of The Black

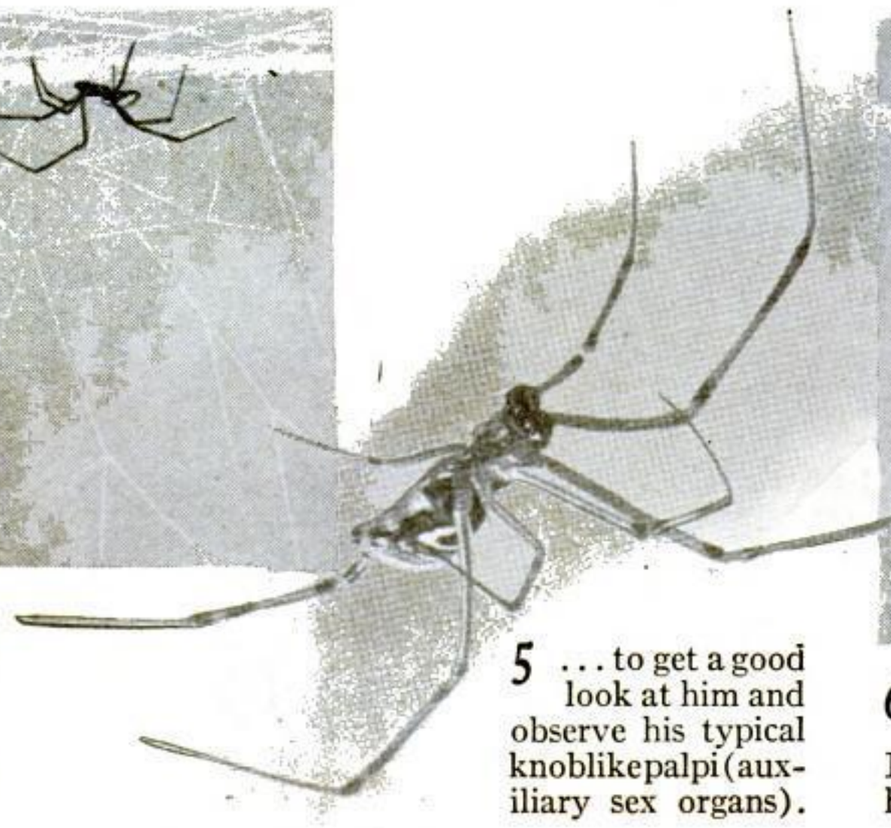
1 Behind the door—of your garage, or shed, or outhouse, almost anywhere in the United States—this lurking menace may be found. The Black Widow (*Latrodectus mactans*) hears the call of spring.

2 So she sheds her girlish rompers (makes her final molt) and modestly retires to her boudoir while Madam Nature finishes her new dress. Then, her trousseau complete. .

3 . . . she makes her debut and enters the matrimonial mart. Perhaps that very night, a slinky vamp in her coal-black dress, she sends out her mysterious love call, which scientists have never been able to explain. (And, please note, the Black Widow is right side up only when she is upside down, hanging in her web like a monkey swinging through a tree. Any other presentation of her is inaccurate.)



4 But, almost as promptly as a radio cop, the bridegroom appears. He is a dancing, prancing dandy, but such a tiny little fellow that we will have to magnify him considerably. .

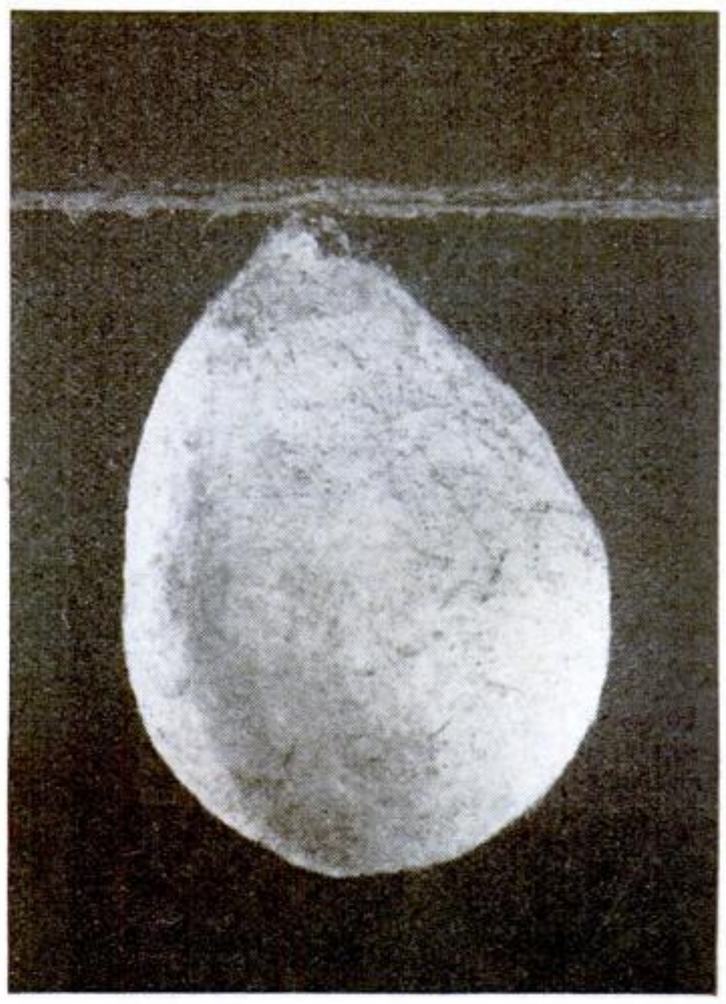


5 . . . to get a good look at him and observe his typical knoblikepalpi(auxiliary sex organs).

6 It's a case of love at first sight. Then follows the brief honeymoon, which lasts for only a few hours. Here the little bridegroom seems to be wondering how he can manage to get his arms around his big, fat wife.

7 And, after the honeymoon, the nursery. With all her faults, the Black Widow is not only a devoted mother, but also a skilled artisan. First, she spins an inverted cup of loose silk. Then she hangs beneath it and lays her eggs upward into the sac in a sticky cluster.

8 Next she pulls down the loose threads and completes the lining of the sac. None too soon, either, for about this time the cohesive liquid evaporates, the egg cluster comes apart, and the eggs fall to the bottom—loose and separate, as they must be to hatch properly.



9 And, finally, with about 2,000 separate "dabs" of paperlike silk, she plasters the framework and completes the sac. The whole process has taken about two hours. Then she mounts guard and takes a rest. The average Black Widow makes five sacs a season.

Widow *and Her Insect Enemy*

Amazing Photographs Show How a Rare Parasite May Curb a Deadly Poisoner

By GEORGE ELWOOD JENKS

CARRYING a poison that is more deadly, drop for drop, than the venom of the rattlesnake, the Black Widow spider has become a real menace to life. Under natural conditions it is kept in check by weather and by its bird and insect enemies. In the artificial shelter afforded by houses, barns, and outbuildings, it is multiplying rapidly, and the mounting toll of deaths from spider bites has become a serious problem to health departments in many states.

Most Black Widow bites could be prevented if people would learn to know and avoid this spider, and if every householder would clear his premises of the pests. Another line of defense suggested by science is the artificial propagation of certain insect parasites that prey on the Black Widow.

This series of exclusive photographs, made by me in connection with spider and parasite research for the Los Angeles County, Calif., Health Department, shows how the Black Widow mates and rears her young. It also introduces her deadly enemy, the tiny parasite fly that may be man's most valuable ally in his war on the insect poisoner.

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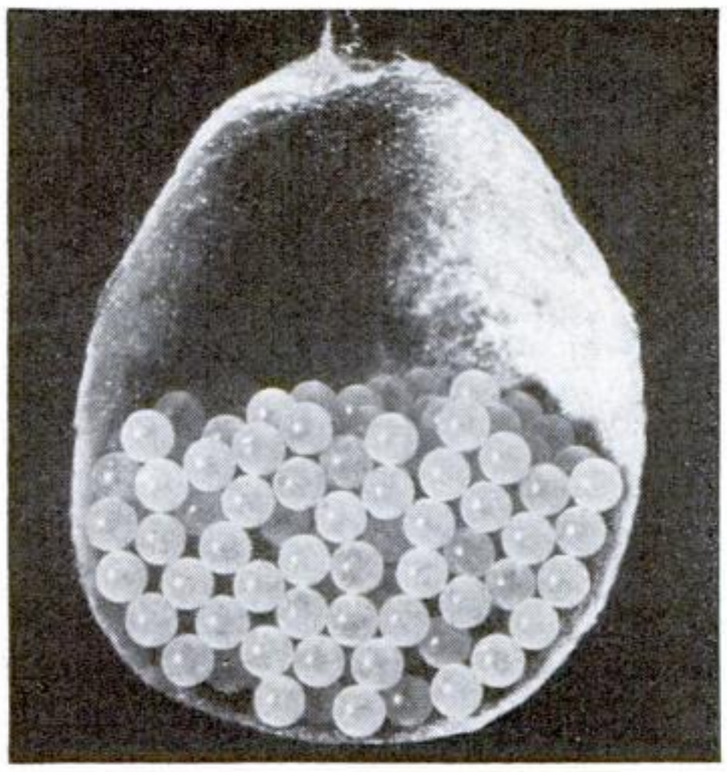
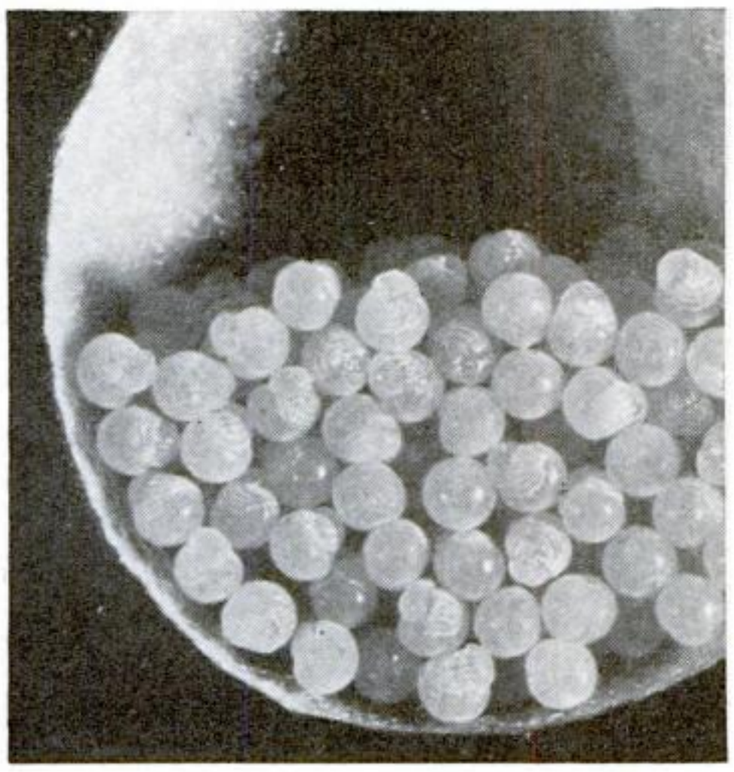
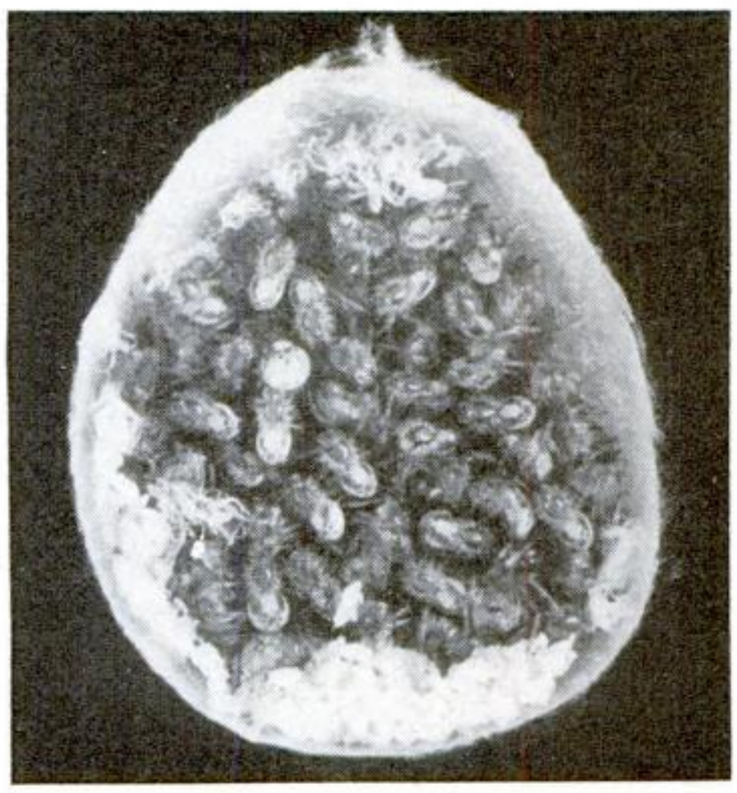


10 Now we will take a peep at the secret life inside the sac. We find that it is about half full of tiny, almost-microscopic eggs. The average number is from 200 to 400.



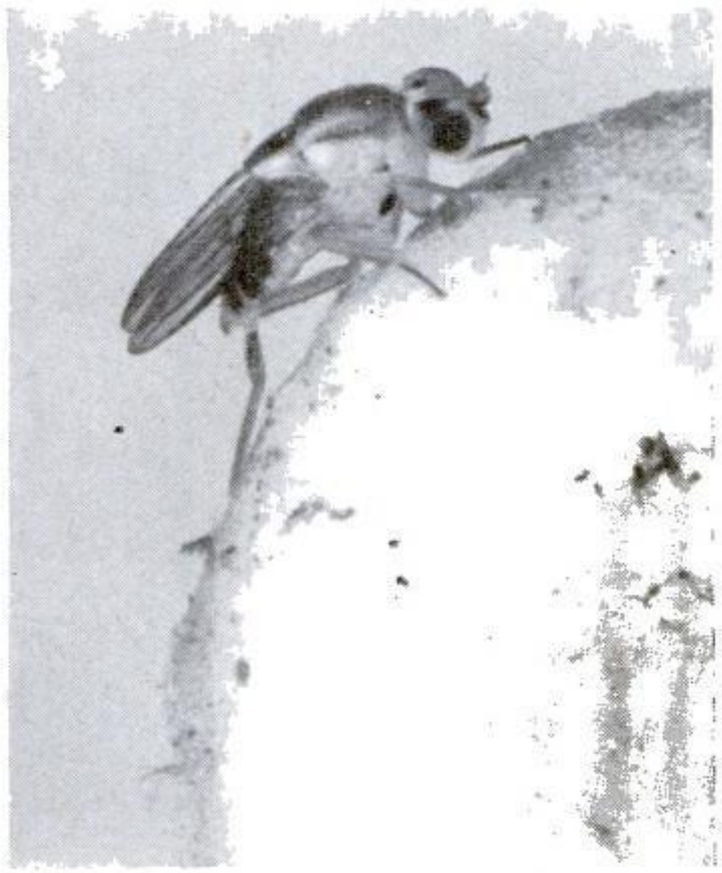
11 Within about ten days, if the weather is warm, we will find the eggs swollen and bulged by the spiderlings within. Then the stretched "eggshells" begin to burst, and . . .

12 . . . all at once, it seems, the cozy little nursery is fairly swarming with a squirming mass of baby spiders. At this stage, they are as transparent and colorless as spun glass.



13 In two to six weeks, depending on the temperature, the spiderlings have grown in size and strength, made their first molt, and taken on the Black Widow markings.

14 And now they are ready to gnaw holes through the wall of the egg sac and scatter to the four winds as potential poisoners. To keep them in check, man may call upon . . .



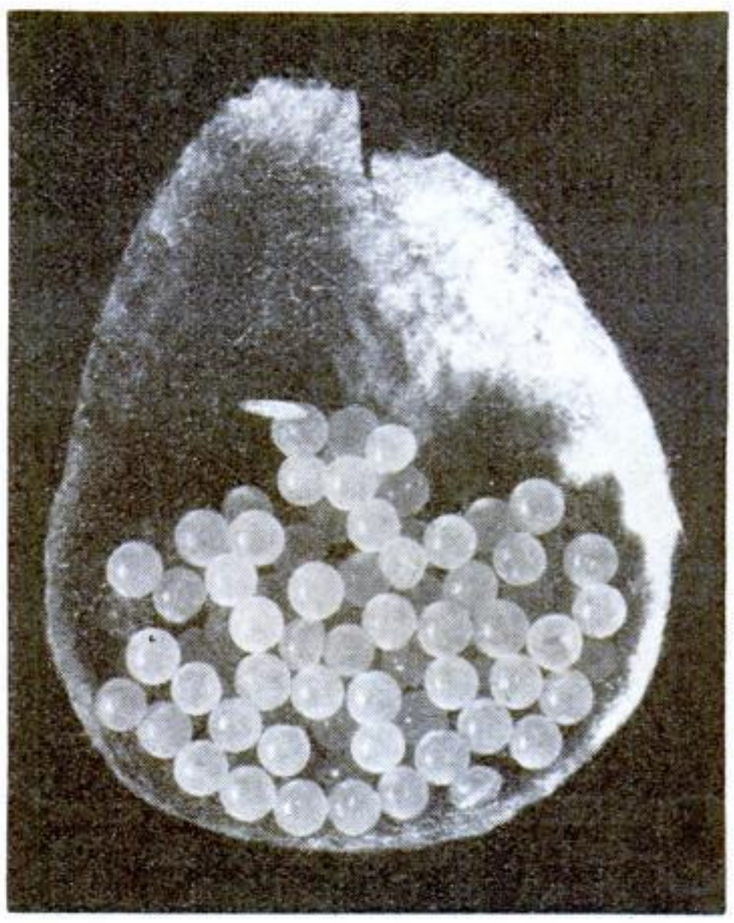
15 . . . the Black Widow's deadly foe, a rare parasite called *Gaurax araneae, Coquillett.* Her chief object in life is to find just such an egg sac as the Black Widow's and . . .

16 . . . lay her own eggs on the surface of the sac. In order to do this, she has to fool the mother spider, who is keeping watch to protect her young from this peril. So . . . .

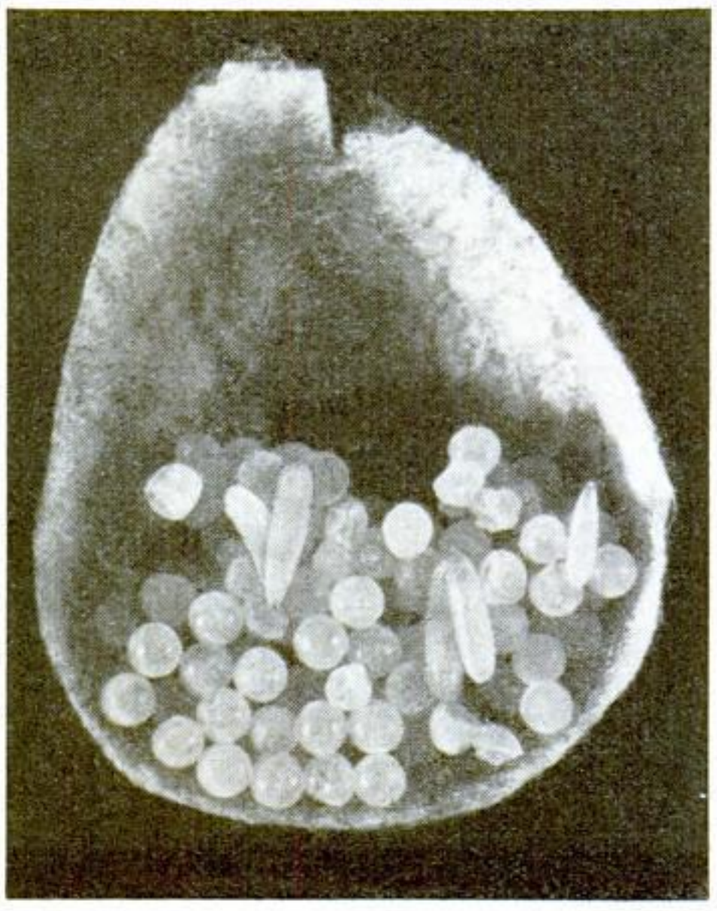
The Black Widow Meets Her Match in a Clever Parasite Fly

17 . . . . the tiny parasite, one fourth as large as a house fly, deposits her eggs on the sac, as a "carrion fly" does on meat.

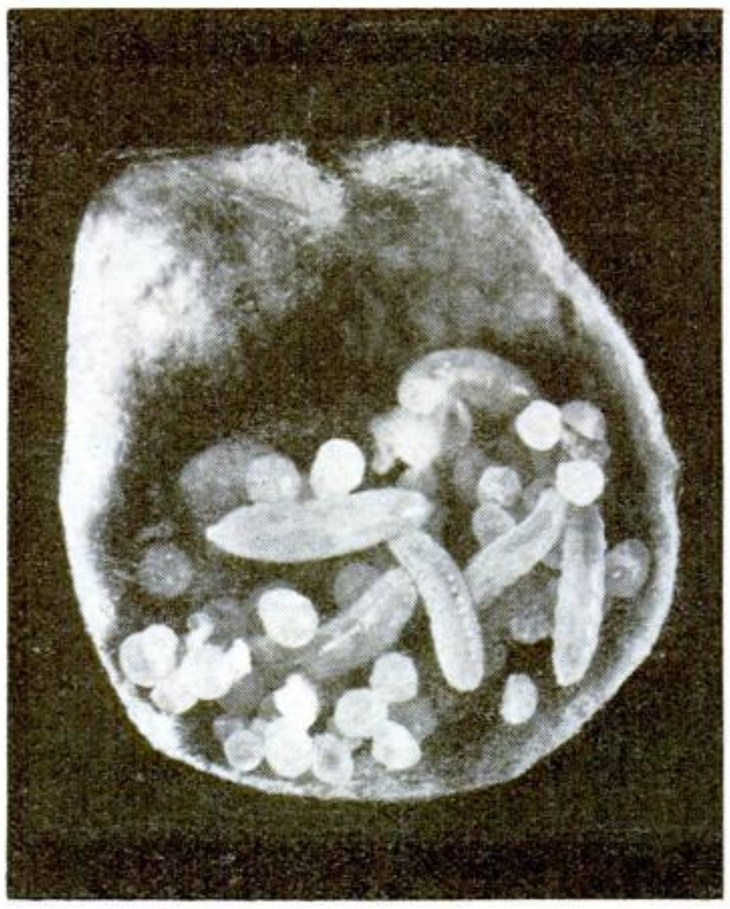
18 In two or three days, the eggs hatch and the tiny maggots (larvae) work their way through the fabric of the sac and begin . .



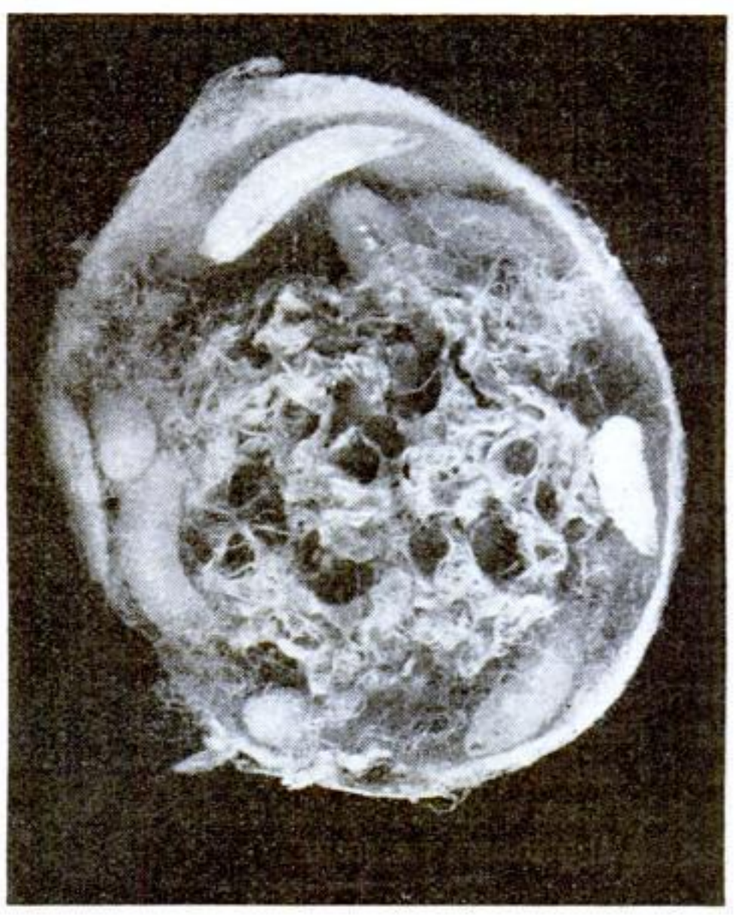
19 . . . feasting on the Black Widow's pearly eggs! Meanwhile, the mother spider is completely unaware of what is going on.



20 On this concentrated food, the fly larvae grow rapidly. The passing of twenty-four hours finds them doubled in size, and the Black Widow's eggs are disappearing fast!



21 Within forty-eight hours, the larvae often attain full growth, and there is nothing left of the Black Widow's pearly eggs except a spongelike mass of debris in which . . .



22 . . . the fat, parasitic larvae proceed to pupate, or pass into the intermediate stage between the larva and the adult insect. And the unsuspecting spider is still on guard!

23 The larvae shorten and thicken until they take on the form of pupae, still white and translucent. Then the cocoons slowly darken until they become a deep, reddish brown. In a few weeks the change is complete . .

24 . . and the adult parasitic flies emerge from the cocoons, gnaw their way out of the sac, and hurry away to find and destroy other Black Widow broods. At the present time, this little parasite is so rare in nature that perhaps only one in fifty or a hundred will happen upon the Black Widow's pretty little egg sac, but when one does, she does a thorough job! With a little assistance from man, these flies may form an army of defense against the poisoner.

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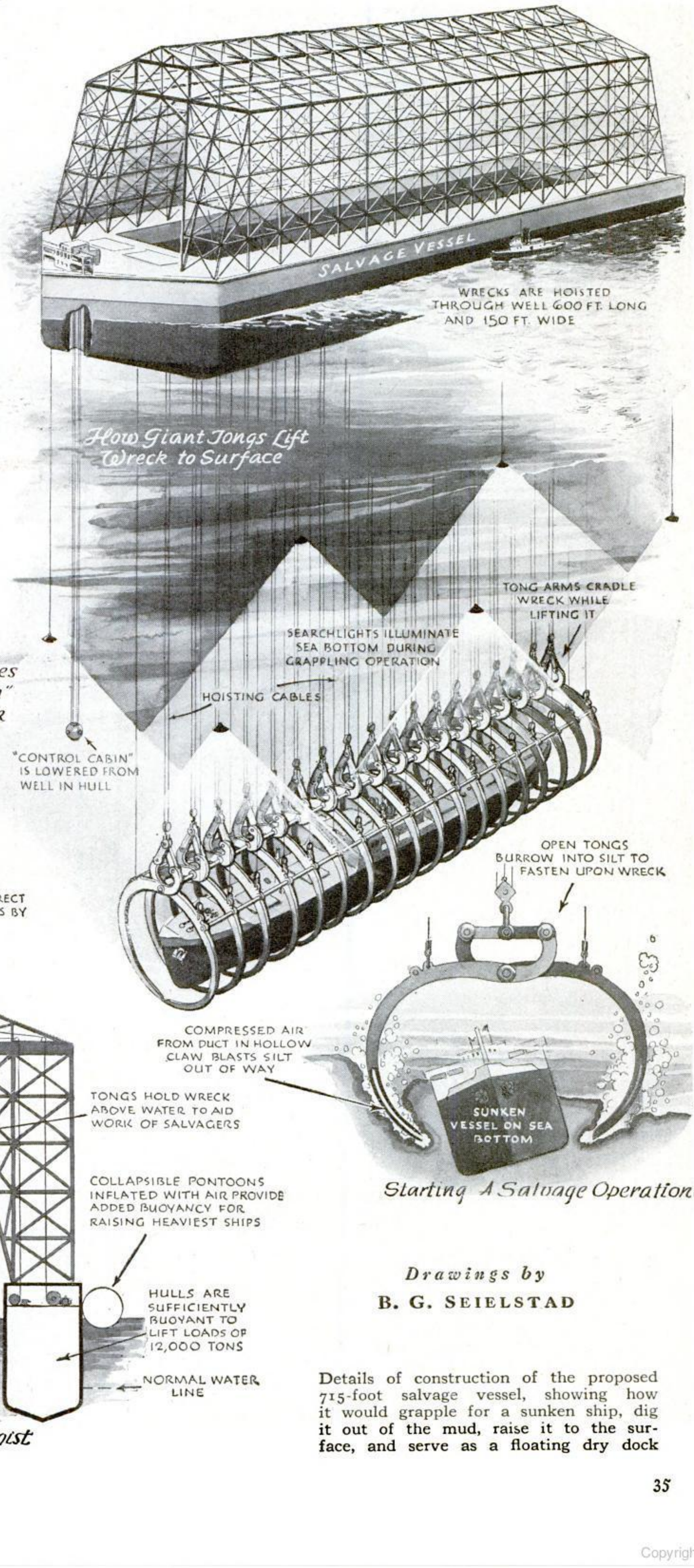
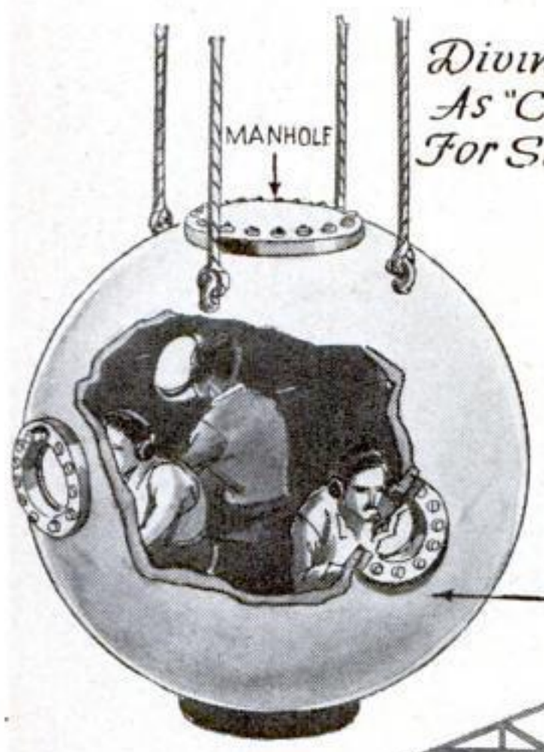
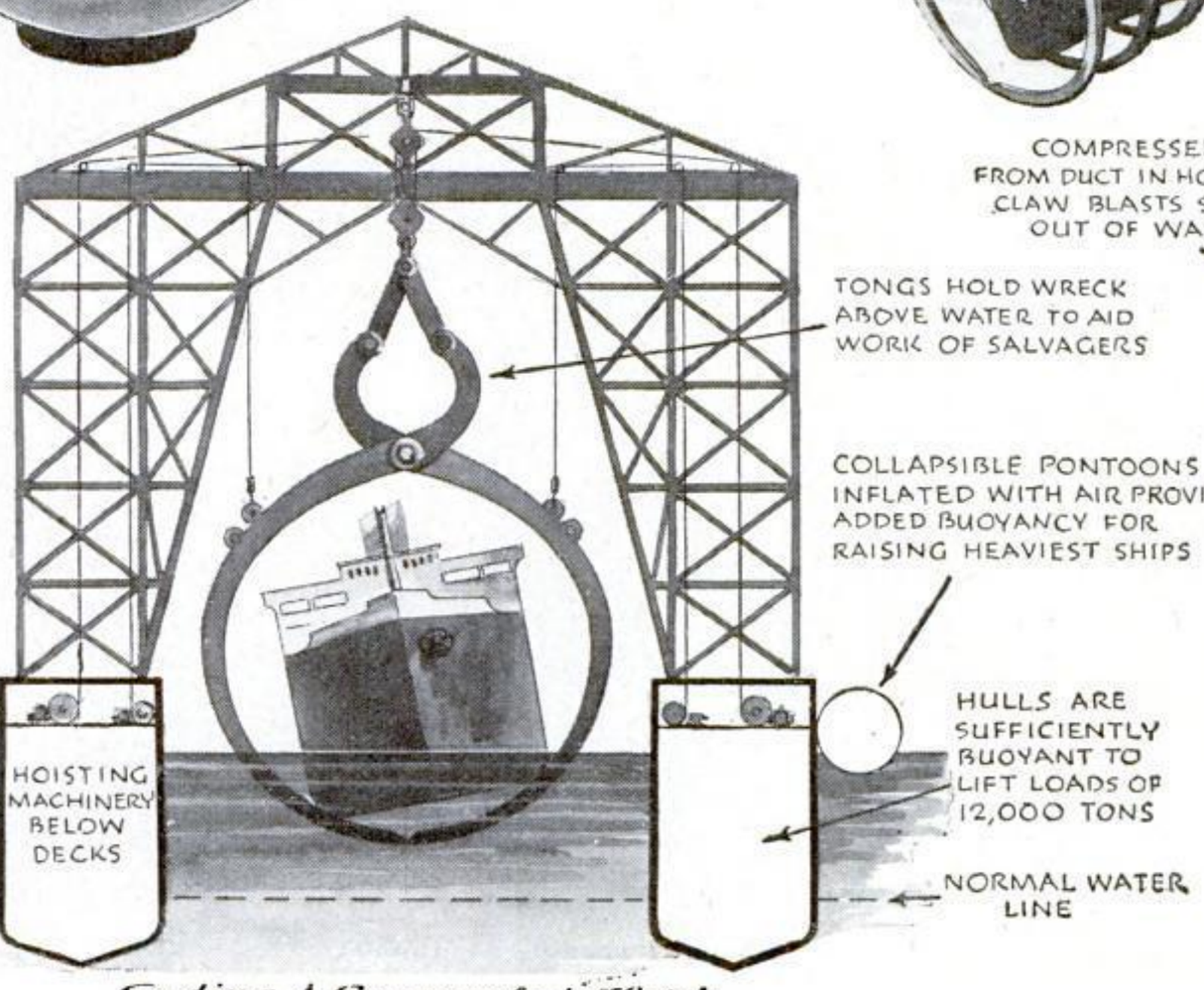
Giant Tongs Raise Sunken Ships

CLAWING the ocean floor with a row of gigantic, seventy-ton grappling tongs, a mammoth 715-foot salvage vessel proposed by a Wyoming inventor would dig wrecked ships out of their watery graves and hoist them to the surface. According to the design, the 100,000-ton craft will be essentially a floating dry dock with an open well, 600 feet long and 150 feet wide, in the center. It will be supported by huge air chambers and propelled by twin-screw Diesel engines. Cables attached to powerful hoisting engines and suspended from a steel girder frame 180 feet above the deck level, will lower the huge open tongs over the submerged vessel. Compressed air, rushing out through a duct in each claw, will blast silt and mud out of the way as the grappling irons bite into the ocean bed and form a steel cradle around the wreck. Submerged searchlights will illuminate the ocean depths, and engineers, lowered in a diving ball, will direct the salvaging operations by telephone until the wreck has been hauled to the surface. The salvage vessel, it is said, could also serve as a rescue ship for submarines.





Diving Ball Serves As "Control Cabin" For Salvage Work



Ending A Successful Hoist

Drawings by
B. G. SEIELSTAD

Details of construction of the proposed 715-foot salvage vessel, showing how it would grapple for a sunken ship, dig it out of the mud, raise it to the surface, and serve as a floating dry dock

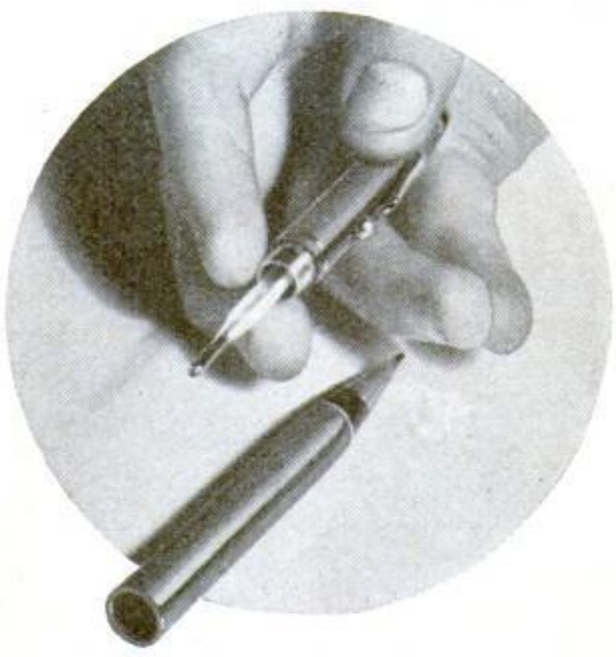
Reporters Get Mobile Telephone Exchange

TO ASSIST reporters in covering outstanding meetings and public events throughout the country, the department of communications in France has fitted out a large truck as a mobile telephone exchange. Equipped with a central switchboard and numerous hand-type telephones, the truck is driven to the scene of an important news event and there connected to local telephone lines. Reporters use the rolling exchange as an office and phone booth to relay news stories by direct wires to their respective papers. Standing at a telephone counter and looking out the truck windows, newsmen can watch outdoor events and phone in the news as quickly as it happens.

At the scene of an important news event, the truck at right serves as office and telephone booth for reporters

PENCIL HOUSES THERMOMETER

A NEW CONVENIENCE for physicians and nurses is a hollow mechanical pencil which also serves as a carrying case for any style of clinical thermometer. Within the body of the jointed pencil, a steel clip grips the thermometer securely to prevent it from falling out accidentally or from shaking around inside the case of the pencil while being carried in the pocket.



A clip holds thermometer in place

BIG SOAP BUBBLES FORM ODD HOBBY

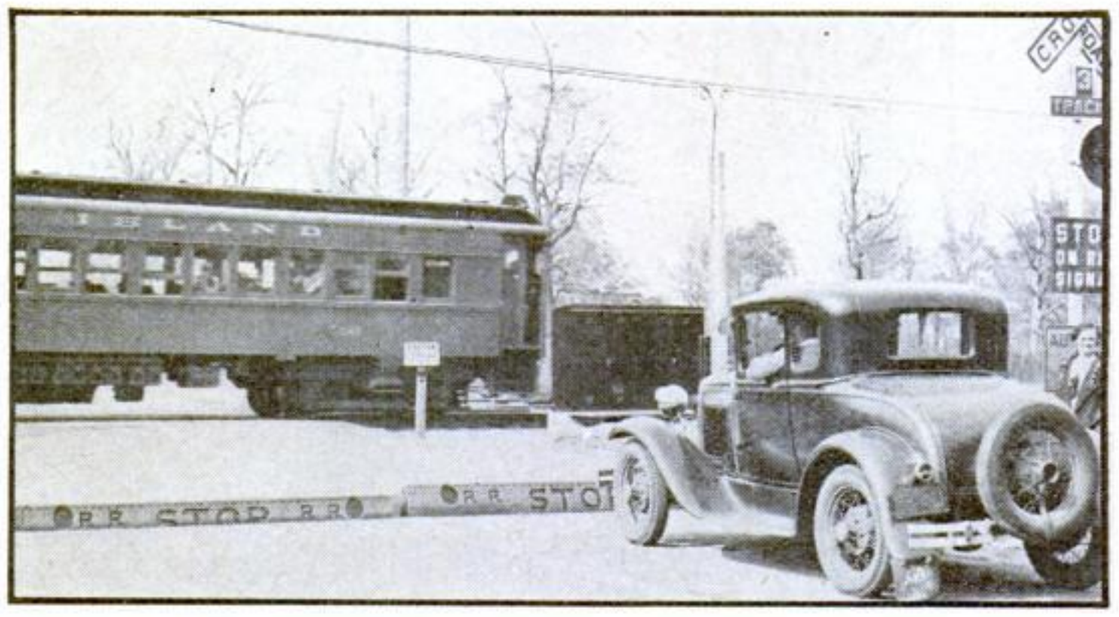
BLOWING giant soap bubbles is the odd hobby of Wallace Block of Buffalo, N. Y. By expert and careful puffing into a homemade paper cone instead of the conventional clay pipe, Block creates mammoth soap spheres with ordinary suds. He is shown in the picture at right finishing off a huge bubble blown around a candlestick on a tin plate, an example of how he manipulates the filmy globules.

BUILDS GARDEN POOL IN LIVING ROOM

BUILT into the center of the living-room floor, a garden goldfish pool gives a novel outdoor note to the new home of a Hollywood film comedian. Ferns and small garden plants grow in a shallow trench which surrounds the concrete fish pond. An urn for ivy and similar plants stands on a pedestal in the center of the pool. Concealed pipes feed the indoor pond with a constant stream of fresh water.

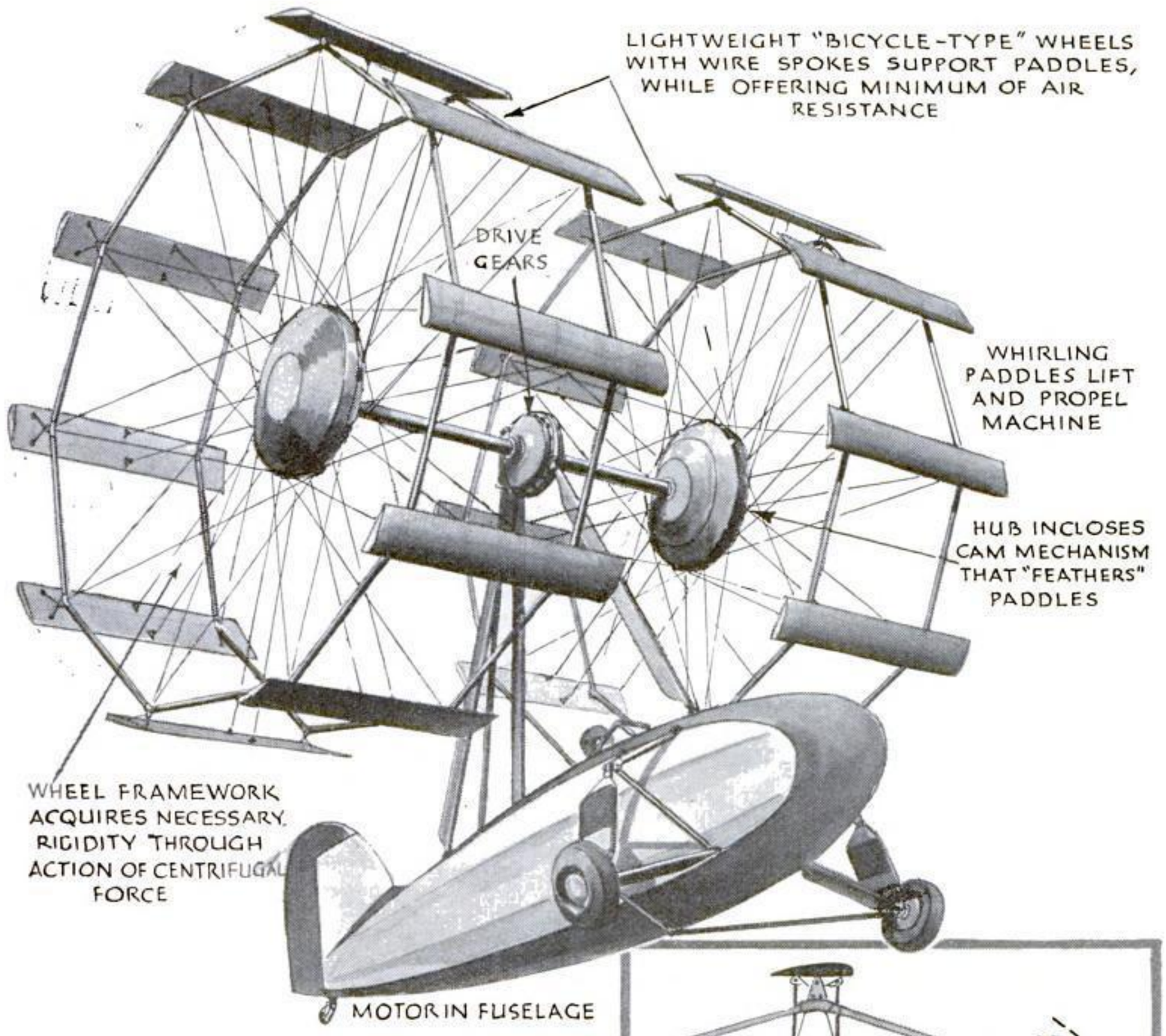
CROSSING GUARDS RISE FROM HIGHWAY

TO PREVENT accidents at unattended railway crossings, a new type of safety guard is being installed by an eastern railroad. When a train approaches the crossing, metal barriers housed in a recess in the highway rise automatically and gradually to a height of nine inches and then lock into position. Thus oncoming cars are first warned by the rising barriers, and then effectively barred from crossing. Fitted with lights and reflectors, the guards automatically drop back into the pavement when the train has passed.

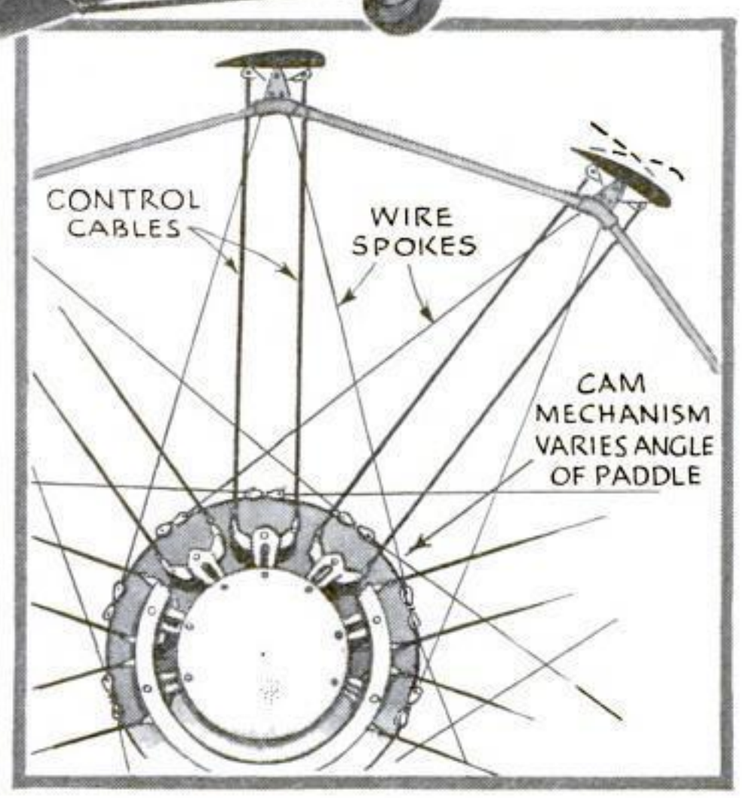


Barriers, rising automatically from the road, warn and stop motorists

Paddle Wheels Drive Plane

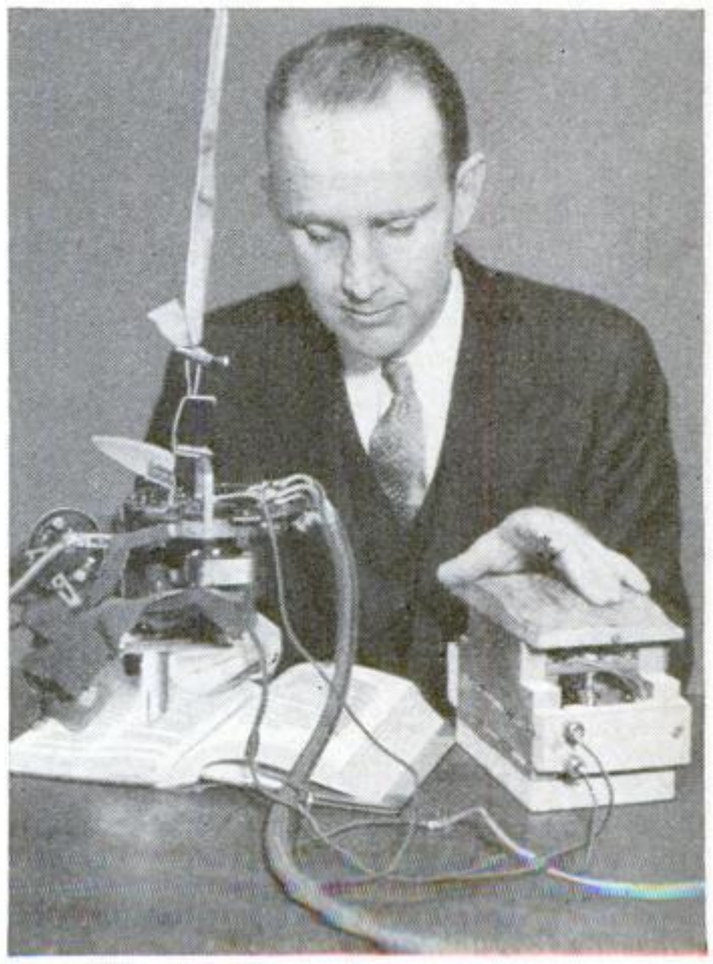


CHURNING the air with wing-shaped paddles mounted on giant, wire-spoked wheels, an odd plane recently devised resembles a pair of flying Ferris wheels. Mounted on a single axle supported by struts jutting upward from the cabin, the "bicycle-type" wheels lift and propel the plane as they are whirled by driving gears connected to a motor in the fuselage. Control cables, attached to a cam mechanism in the hub of each wheel, vary the angles of the paddles during each revolution to gain the maximum lift and forward speed. The light frames acquire rigidity through the action of centrifugal force.



PUTS STRIPES ON CARS

DECORATIVE lines on automobiles are easily painted with a new striping device. Working like a fountain pen, the liner has a knurled roller tip which assures a steady flow of paint from the supply reservoir. An adjustable wire guides the device and holds it steady when in use. Tips of various sizes can be inserted for wide or narrow stripes. Lacquer, varnish, enamel, or heavy ink may be used in the striper as well as paint.



BLIND CAN READ PRINT WITH ELECTRIC EYE

BLIND PERSONS can "read" ordinary printing with a new scanning device now being perfected at Northwestern University. Suspended over a printed page, the apparatus is guided on small rollers along a line of type flooded with strong light. A powerful lens projects a magnified image of each letter onto a circular scanning disk. Converted into electric current by a sensitive photo-electric cell, the scanned letters raise small glass buttons on a wooden receiving unit under the reader's hand. Each letter produces a distinctive movement of the reading buttons so that words are "spelled out" on the hand of the sightless reader.

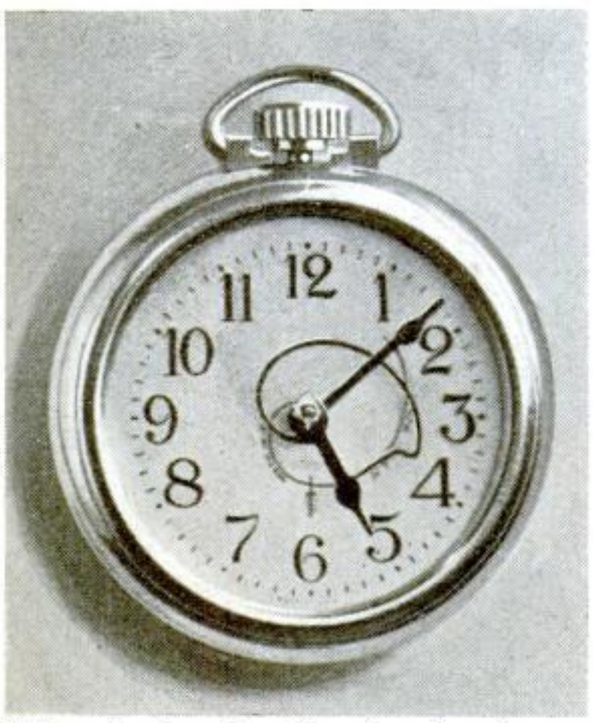
"BOOKS" ON FILM SAVE LIBRARY SPACE

This reading machine has a screen on which type is projected from a film. The crank "turns the pages"

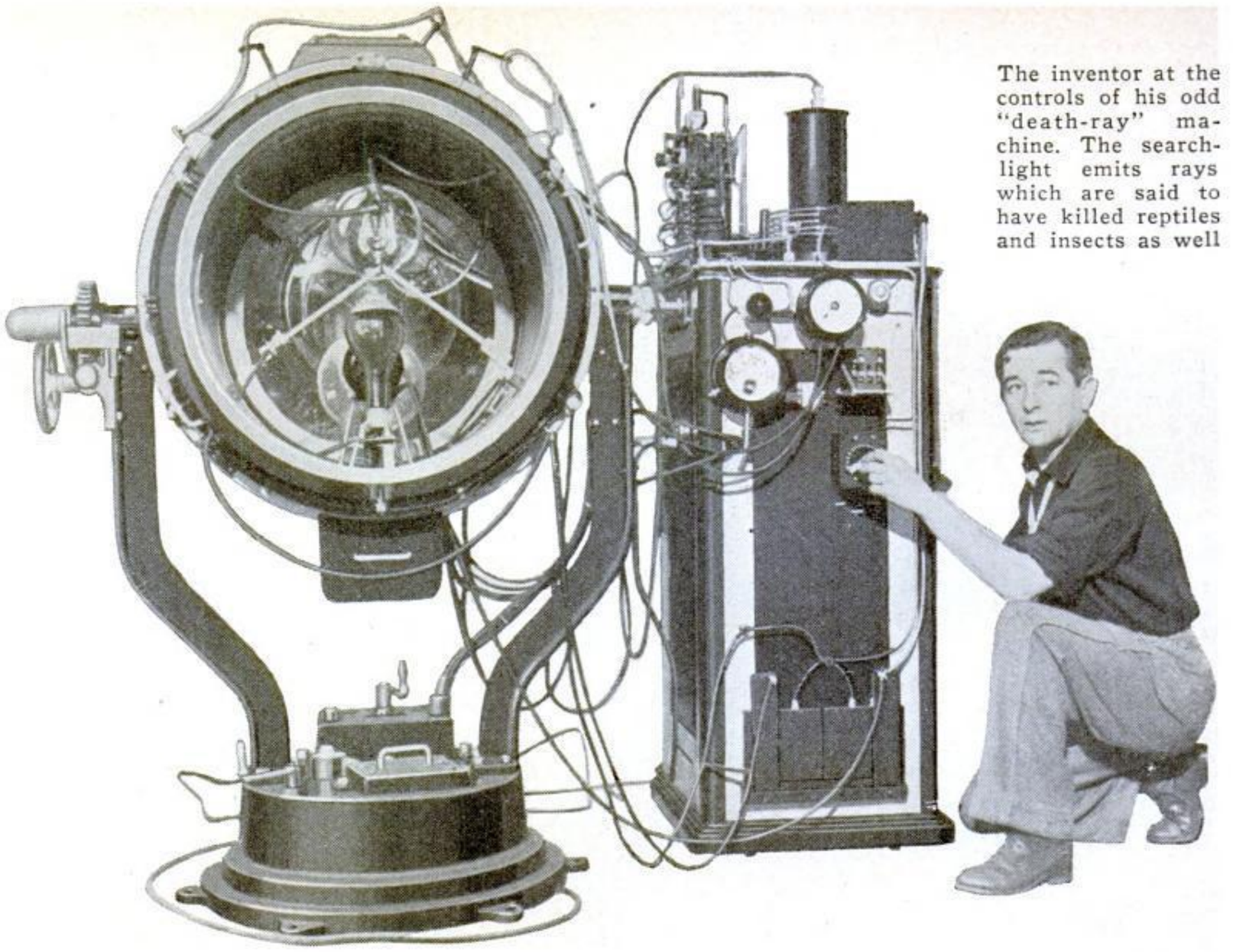
TINY ROLLS of movie film may replace books, magazines, and newspapers in the libraries of the future, if a new reading machine comes into general use. Microphotographs are made of printed pages so that an entire novel can be reproduced on a few feet of noninflammable, durable film. When this "film book" is placed in the reading device, the type is projected onto a small screen, where it appears full size and legible in ordinary daylight. A crank on the apparatus enables the reader to move the film. The inventors expect that their process will answer the problem of storage space in libraries; the contents of the large New York Public Library, concentrated on film, could be stored in one small room, it is said. A 1,000-foot reel of film will hold the equivalent of 100 books.

NEW COMPASS-WATCH TELLS DIRECTION

BOTH time and direction are indicated by an ingenious combination compass and watch, recently devised for use by sportsmen, explorers, and engineers. A thin strip of metal, shaped into a carefully calculated curve, is soldered to the hour hand near its axis, while a thin line which curves in an opposite direction is drawn on the watch face. When the hour hand is pointed at the sun, north is indicated by the intersection of the fixed and moving curves.



When the hour hand is pointed at the sun, the place where the wire crosses the curved line on the dial indicates the north



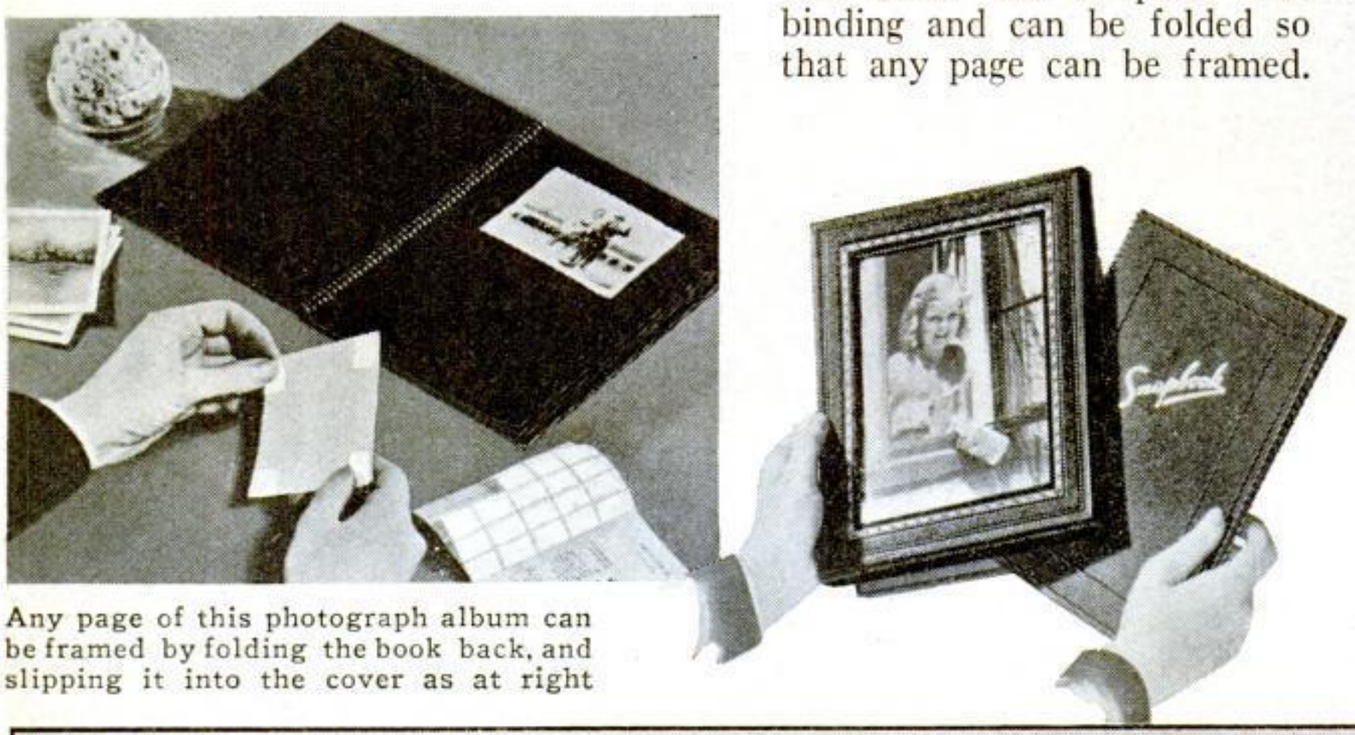
The inventor at the controls of his odd "death-ray" machine. The searchlight emits rays which are said to have killed reptiles and insects as well

TRIES "DEATH-RAY" MACHINE ON SNAKE

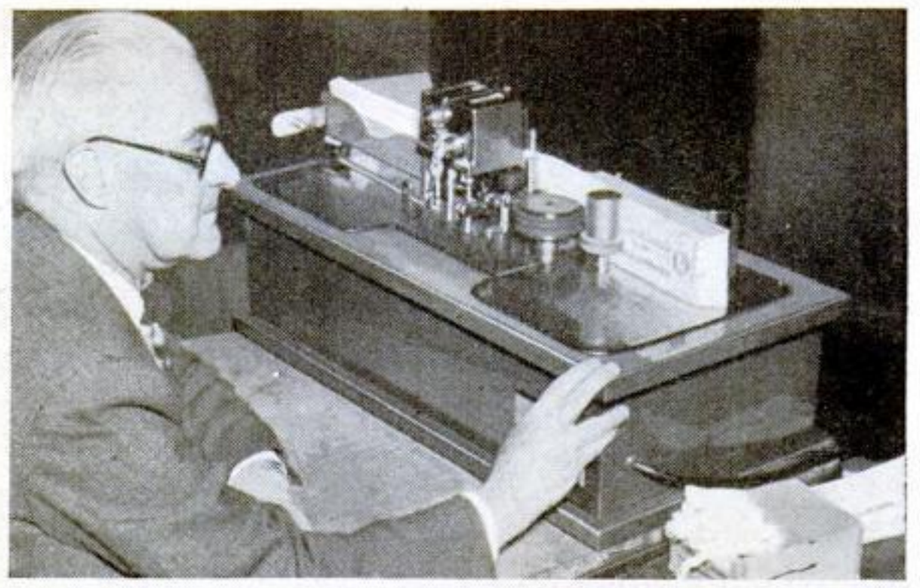
LETHAL BEAMS of light radiate from an electric "death-ray" machine developed by a California inventor. The apparatus is said to project a mixture of ultrashort radio waves and infra-red radiations from powerful lamps mounted in a searchlight. In a recent test, its rays are said to have killed a snake in nine minutes; insects in thirty seconds.

ALBUM COVER IS FRAME FOR PICTURE

BY INSERTING a new photograph album into a picture frame recently introduced, photographers can display their favorite snapshot without removing it from the album. Finished to resemble leather, the frame opens at the back to admit the album. The latter has a spiral wire binding and can be folded so that any page can be framed.



Any page of this photograph album can be framed by folding the book back, and slipping it into the cover as at right



SIGNS 12,000 CHECKS AN HOUR

CHECKS sent out by the Federal Government are automatically signed and countersigned by a new machine recently placed in operation by the United States Treasury Department. Capable of affixing signatures at the amazing rate of 12,000 an hour, the device is for use on Government payroll checks and such obligations as World War bonus payments.

NAVY GETS RESCUE BOAT FOR SEAPLANE MISHAPS

SKIMMING over the water at a top speed of forty-five miles an hour, a new "crash boat" completed for the U. S. Navy will rescue student flyers and their planes in case of accidents near their seaplane training base. Powered by four 300-horsepower marine engines, the twenty-one-ton rescue boat is thirteen feet wide and has an inverted V-type hull. A derrick set up in the bow of the craft will be used for raising or supporting damaged planes. The central cabin is fitted with complete emergency medical and nursing equipment to care for injured flyers.

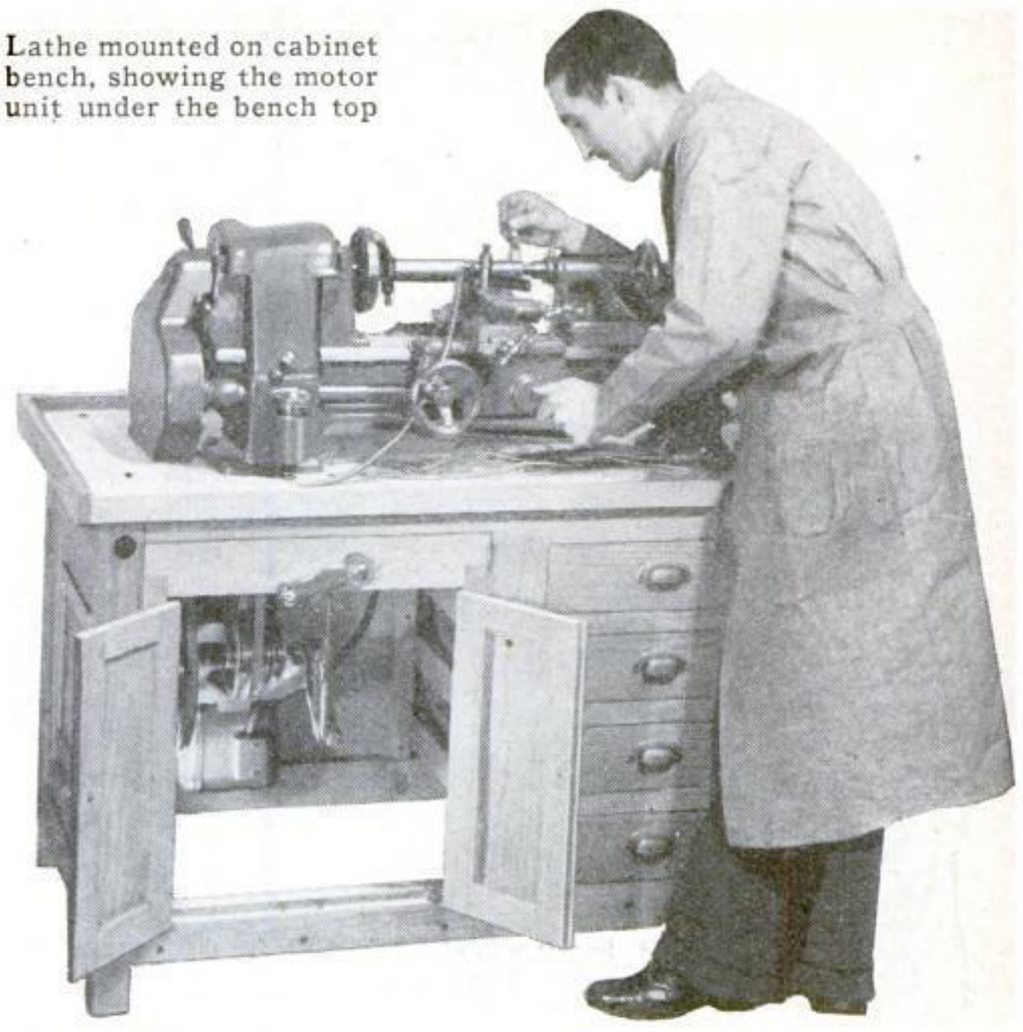
TORCH RELAY RUN TO OPEN OLYMPICS

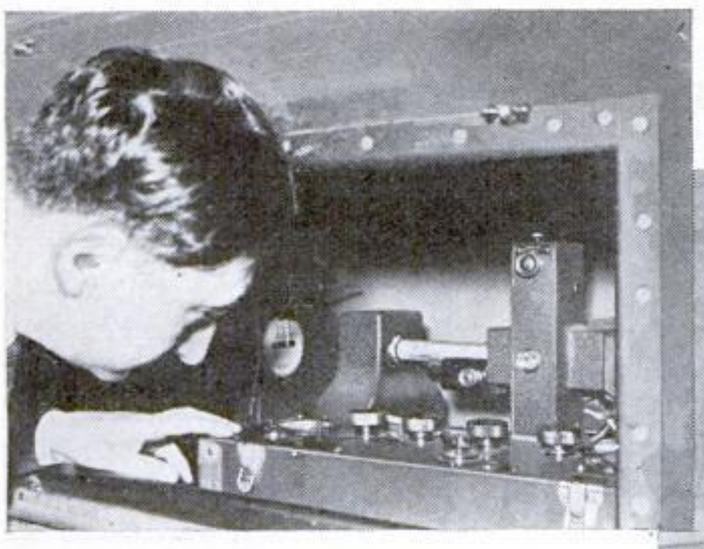
TORCHES borne by athletes of old have been brought up to date for the first modern observance of an ancient ceremony. More than 3,000 runners, bearing flaming stainless-steel torches like the one illustrated, will take turns in carrying a symbolical flame 1,900 miles from Olympia, Greece, to Berlin, Germany, to mark the opening there of the 1936 Olympic games.

NEW LATHE HAS NOVEL MOTOR DRIVE

BY PLACING its drive directly beneath the bench top to which it is fastened, instead of overhead or at the rear, the designer of a new metal-working lathe for home-workshop enthusiasts provides novel advantages. Turning a crank handle within easy reach raises the pivoted driving unit to release the belt and facilitate shifting it for varying spindle speeds. Belt tension is adjustable by a readily accessible turnbuckle. No moving parts are exposed, and there are no overhead obstructions to impair vision. There are two styles, a flat belt and a V-belt; the former has six spindle speeds, the latter eight.

Lathe mounted on cabinet bench, showing the motor unit under the bench top



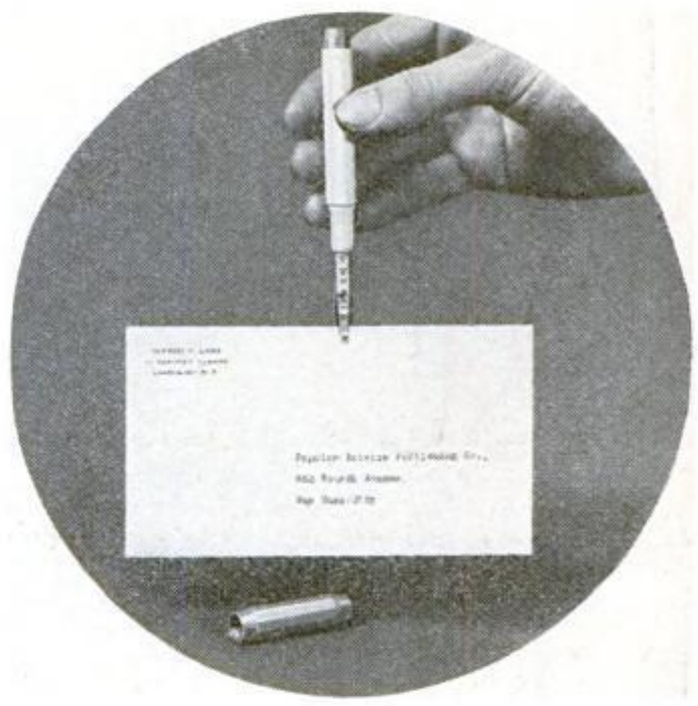


TAPS NERVE CURRENTS TO MEASURE JITTERS

"NERVOUSNESS" is measured by an electrical device recently developed by Dr. Edmund Jacobson of the University of Chicago, which gauges the electrical activity of a subject's nervous system. Fine wires are inserted directly into a superficial nerve, and the heavily-shielded apparatus registers electric currents as small as four millionths of a volt. Grounded copper screening insulates the patient from electrical impulses in the air.

Wires inserted in a subject's arm. Inset shows recorder

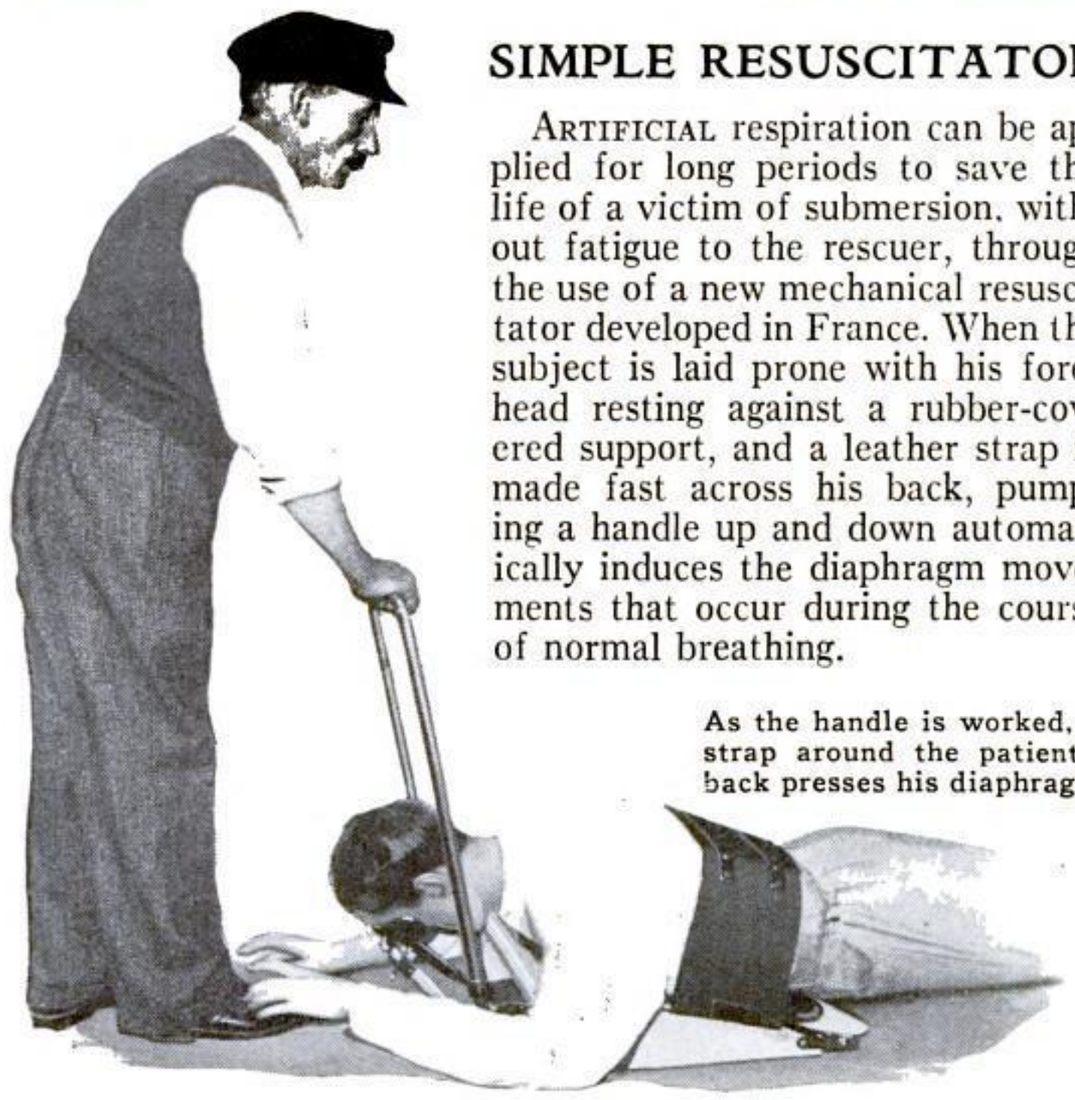
POCKET LETTER SCALE



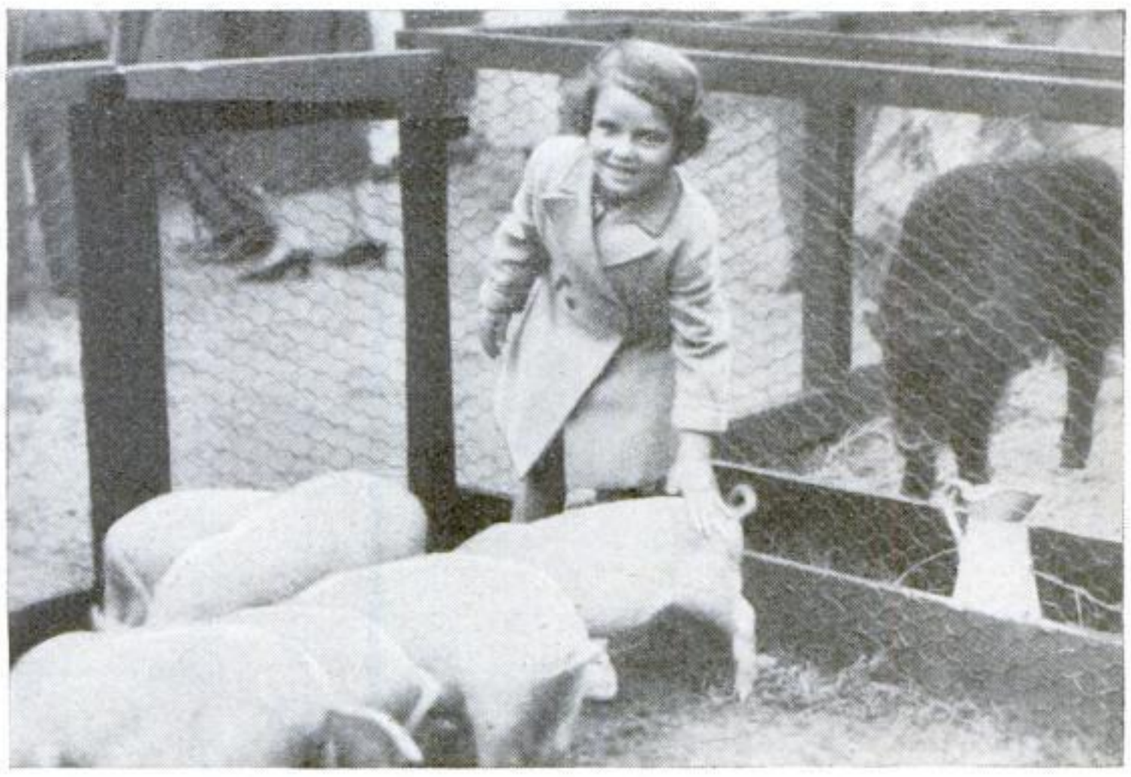
RESEMBLING a fountain pen, a new pocket scale weighs letters and small packages to determine the postage required. A letter, held in a clip at one end of the scale, pulls down a calibrated rod attached to a small spring.

SIMPLE RESUSCITATOR

ARTIFICIAL respiration can be applied for long periods to save the life of a victim of submersion, without fatigue to the rescuer, through the use of a new mechanical resuscitator developed in France. When the subject is laid prone with his forehead resting against a rubber-covered support, and a leather strap is made fast across his back, pumping a handle up and down automatically induces the diaphragm movements that occur during the course of normal breathing.



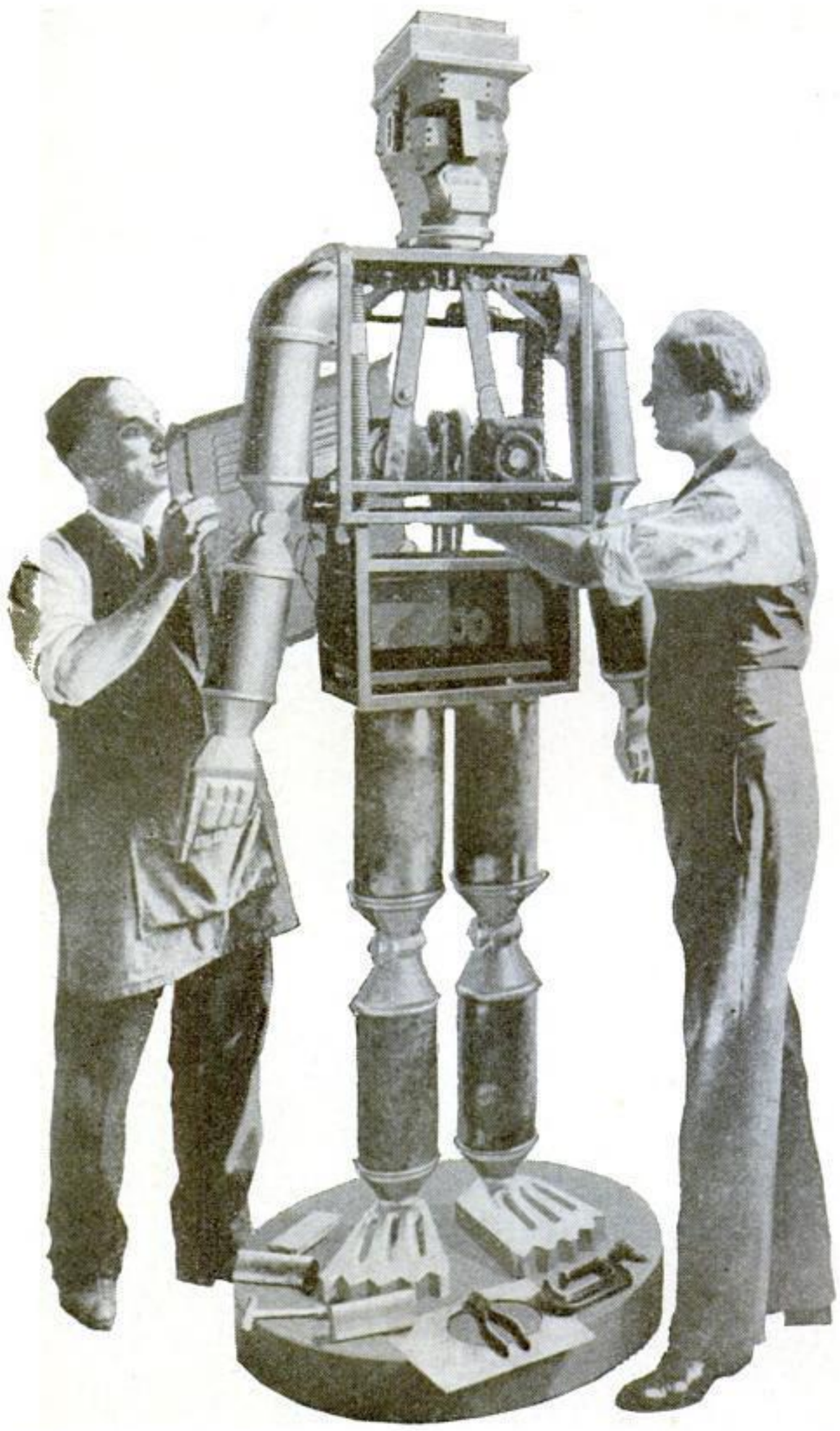
As the handle is worked, a strap around the patient's back presses his diaphragm



KIDS MEET CUBS IN ZOO'S "PET CORNER"

UNDER the watchful eyes of keepers, children play with lion cubs, pigs, penguins, parrots, small pythons, a chimpanzee, and other animals in a novel "Pets Corner" in the London, England, Zoo. The idea, as the picture indicates, is a popular one.

ROBOT SPEAKER TELLS ABOUT MACHINES



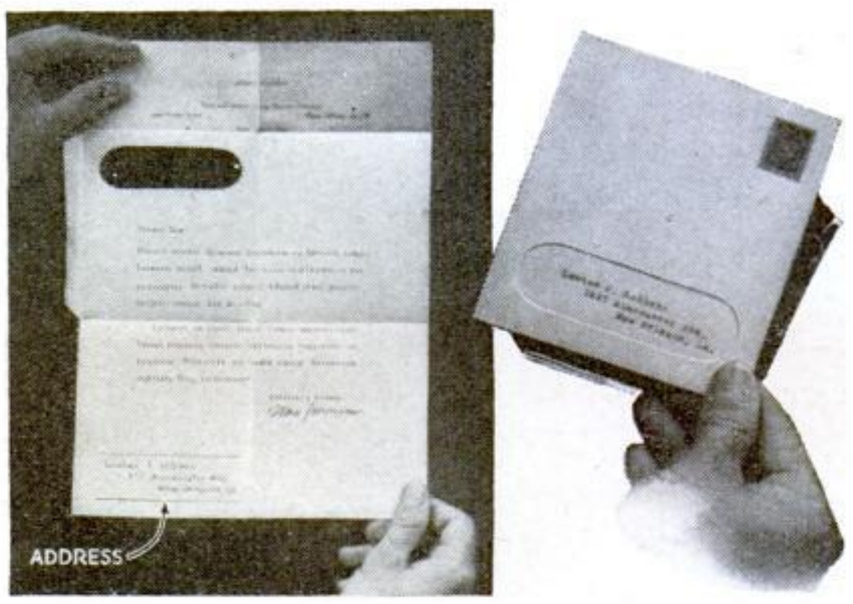
Workmen assembling the intricate mechanism of the automaton

GESTURING realistically with its long metal arms and turning its massive head from side to side, a mechanical man recently constructed makes an animated educational speech on the subject of "Men and Machines," as part of the exhibit of the U. S. Department of Labor at the Texas Centennial Exposition. A complicated, electrically operated mechanism, housed within the steel-plated torso of the seven-foot robot, synchronizes lip, arm, and head movements with the recorded speech reproduced through concealed loudspeakers. The metal giant gives frequent four-minute lectures.

BELL GIVES GALE WARNING

BY RINGING a bell whenever the wind reaches gale proportions, a device mounted on a railroad viaduct in England warns that the bridge is unsafe. The wind's velocity is measured by its pressure on a disk attached to a spring.

LETTER PAPER FOLDS TO FORM ENVELOPE



WHEN a letter is written on a new type of writing paper, it is folded and sealed with a small, gummed flap projecting from the side of the sheet. The address, written in the lower left-hand corner of the letter, is visible through a window cut in the paper, saving the cost of an envelope and the work of addressing one.

Miss Mary Towers measuring rainfall in historic gauge

EIGHTY-YEAR RAIN RECORD

THRICE daily for eighty years, members of a Rome, Ga., family have made rainfall observations on a rain gauge set up in the back yard of their home. R. F. Norton, an amateur weather observer, designed and erected a gauge there in 1856, and kept records for twenty-four years. His descendants carried on the tradition, and Miss Mary Towers, a granddaughter, now checks the gauge morning, noon, and evening as a volunteer observer for the U. S. Weather Bureau. She also checks the level of near-by Coosa River.

"ELECTRIC DOCTOR" DETECTS DISEASE

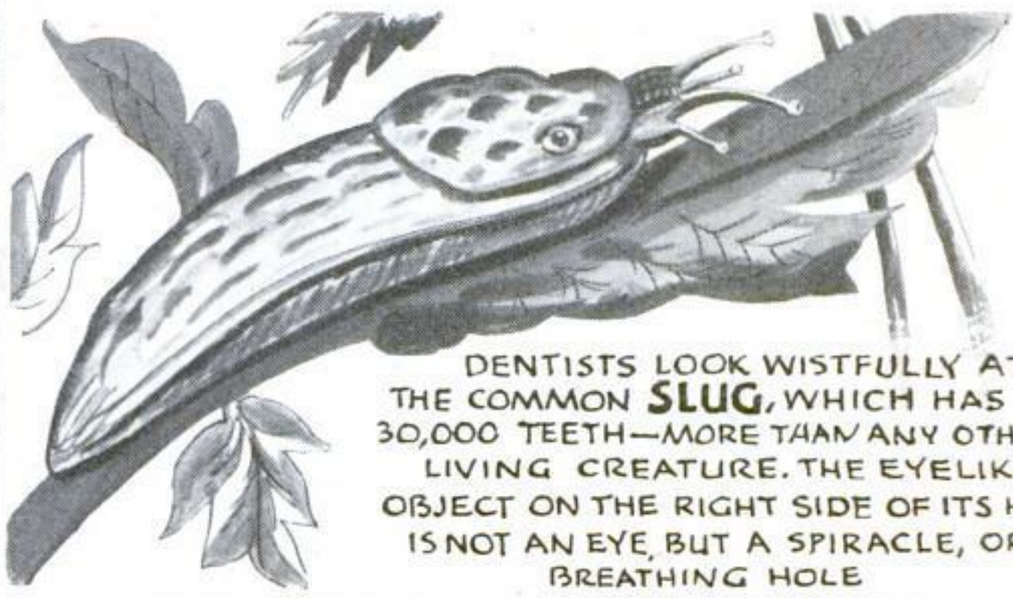
DETECTING the presence of disease or infection in the human body is the reputed accomplishment of an electrical machine recently demonstrated in London, England. The device operates on the theory that disease causes a change in the electrical capacity of the parts affected. When its terminals are held against the patient, a band of light moves along a calibrated scale to indicate the strength of electric currents coming from a given area.

Physicians watching a demonstration of the "diagnostic galvanometer" for locating infection

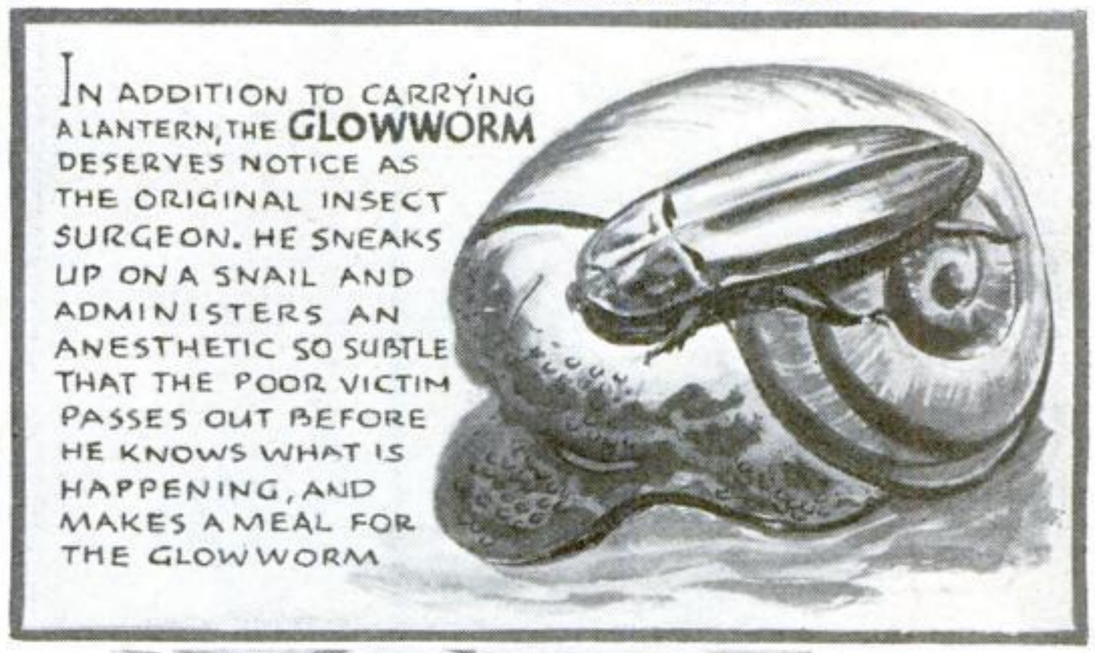
Un-Natural History

By GUS MAGER

LARGEST OF ALL CRUSTACEANS, THE **GIANT SPIDER CRAB**, FOUND IN JAPANESE WATERS, SOMETIMES MEASURES TWELVE FEET FROM CLAW TO CLAW, AND WOULD MAKE ENOUGH CRAB-MEAT SALAD FOR A WHOLE CHAMBER-OF-COMMERCE LUNCHEON



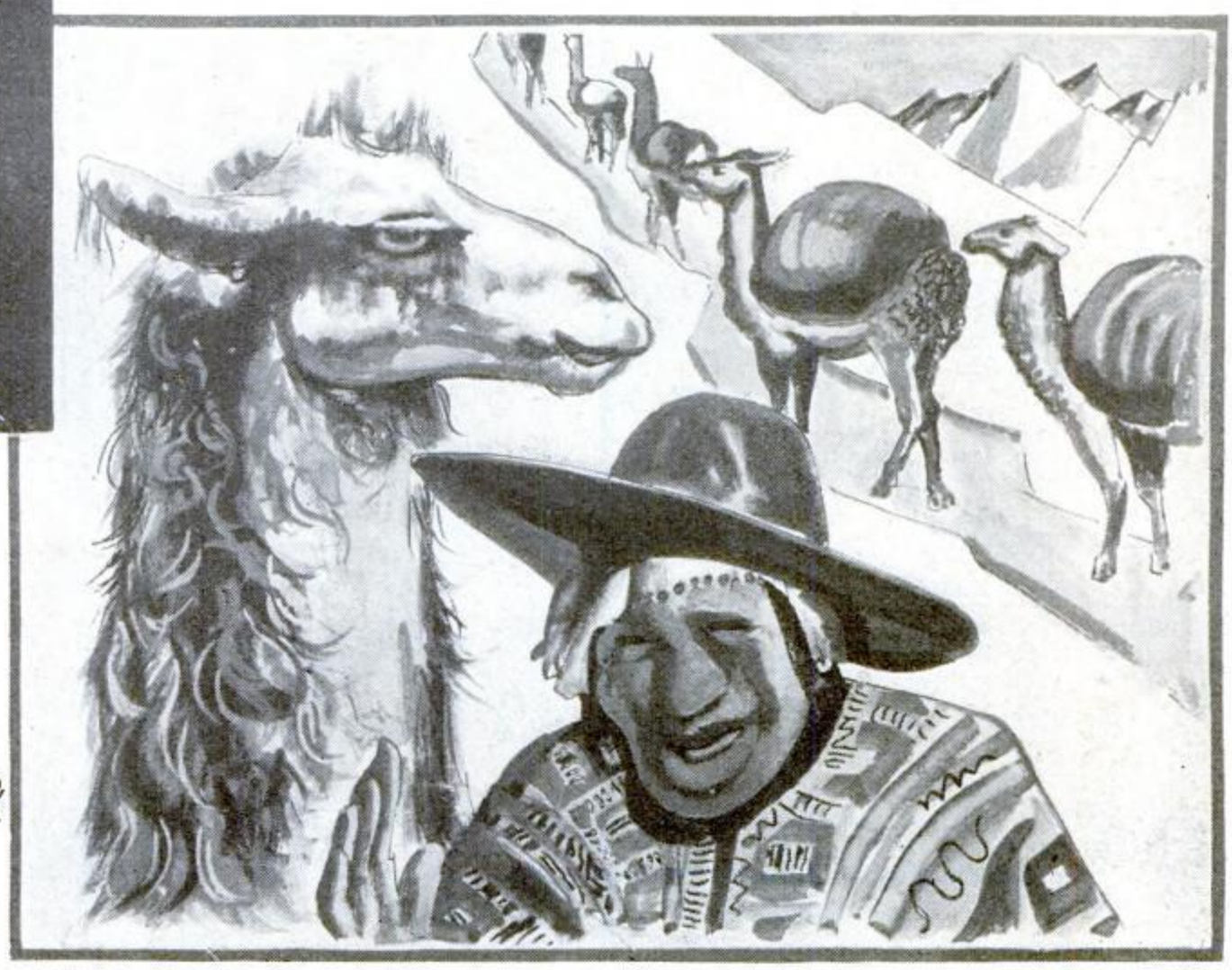
DENTISTS LOOK WISTFULLY AT THE COMMON **SLUG**, WHICH HAS 30,000 TEETH—MORE THAN ANY OTHER LIVING CREATURE. THE EYELIKE OBJECT ON THE RIGHT SIDE OF ITS HEAD IS NOT AN EYE, BUT A SPIRACLE, OR BREATHING HOLE



IN ADDITION TO CARRYING A LANTERN, THE **GLOWWORM** DESERVES NOTICE AS THE ORIGINAL INSECT SURGEON. HE SNEAKS UP ON A SNAIL AND ADMINISTERS AN ANESTHETIC SO SUBTLE THAT THE POOR VICTIM PASSES OUT BEFORE HE KNOWS WHAT IS HAPPENING, AND MAKES A MEAL FOR THE GLOWWORM

IN THE **CANNON BALL RIVER** COUNTRY OF THE DAKOTAS ARE FOUND THESE REMARKABLE ROUND STONES, SOME OF THEM THREE FEET IN DIAMETER. THEY WERE FORMED AROUND FOSSIL OBJECTS IN THE DIM PAST WHEN THE DAKOTAS WERE BENEATH THE SEA

A MILE DOWN IN THE PITCH-BLACK DEPTHS OF THE OCEAN LIVES THE **CHIASMODON NIGER**. THIS MARINE MONSTROSITY HAS A STOMACH SO ELASTIC THAT IT CAN SWALLOW OTHER FISH OF GREATER BULK THAN ITSELF, AND THREE TIMES AS LONG. SOME BAY WINDOW!



THE **LLAMA** OF SOUTH AMERICA IS THE "SHIP OF THE MOUNTAINS" AS THE CAMEL IS THE "SHIP OF THE DESERT," BECAUSE IT, TOO, CAN TRAVEL GREAT DISTANCES WITH LITTLE FOOD AND WATER. THE ANCIENT INCAS OF PERU DOMESTICATED THOUSANDS OF THESE CURIOUS ANIMALS SO LONG AGO THAT NO WILD MEMBERS OF THE FAMILY REMAIN

Dancing

NO MATTER where you explore with your microscope, you may find nematodes, dragonlike worms which are engaged constantly in a writhing dance, and whose numbers are believed to be greater than the insect population.

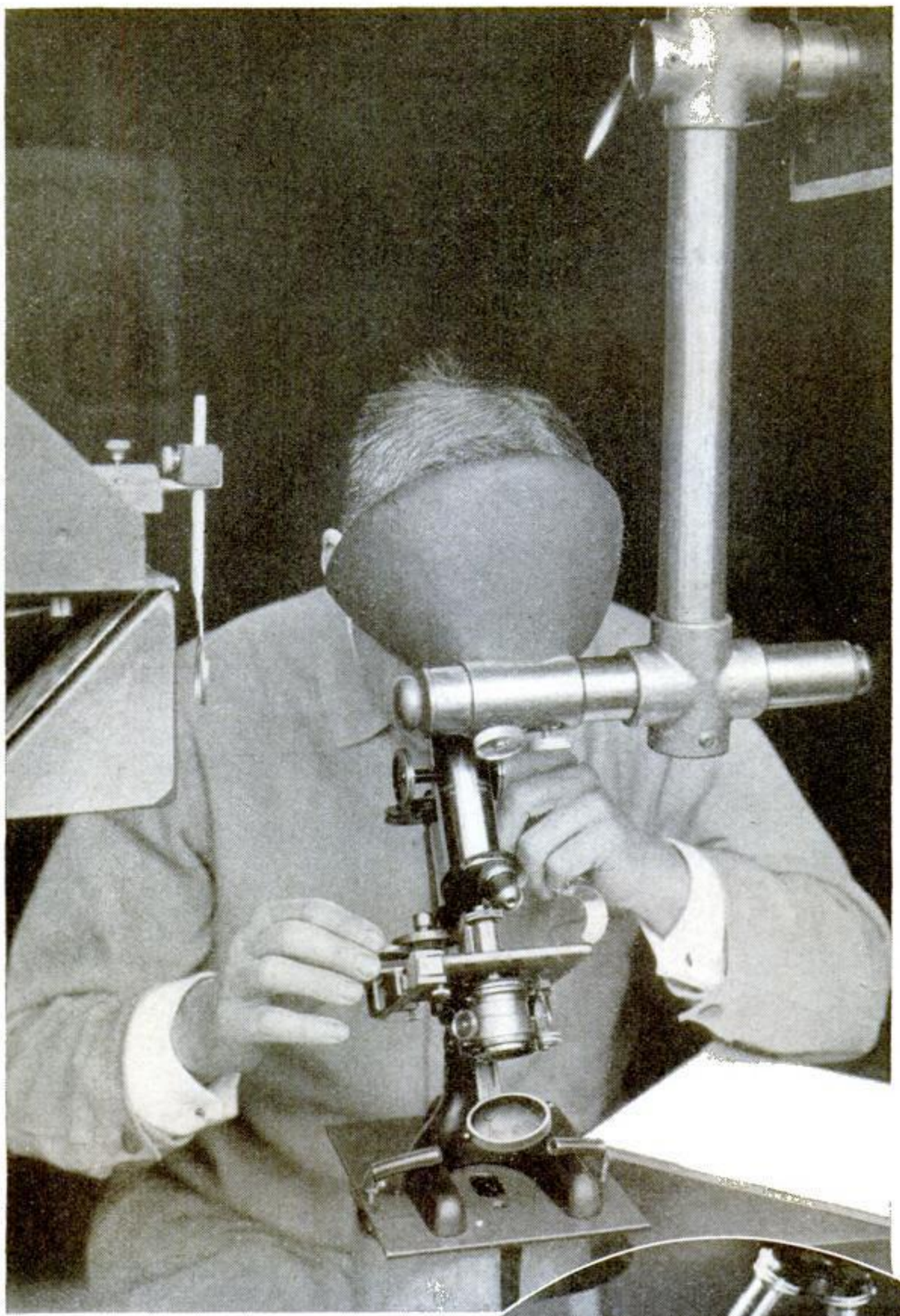
Amazing are the variety and distribution of these important but, to the average person, almost unknown creatures. Many kinds, known variously as threadworms and roundworms, live in fresh water. Other thousands of species are found in the soil and in the sea. There seem to be few animals, from the tiniest insect to the biggest quadruped, in which they are not found as parasites. Some nematodes even have smaller nematodes living inside their bodies!

With such abundance, it ought not to be difficult for the amateur microscopist to discover enough of these minute worms to keep him busy for a long time. He can find them in almost every sample of mud, sand, aquatic vegetation, or decaying plant material from ponds, lakes, streams, or seas in any part of the world. He even can find them in the family vinegar jug.

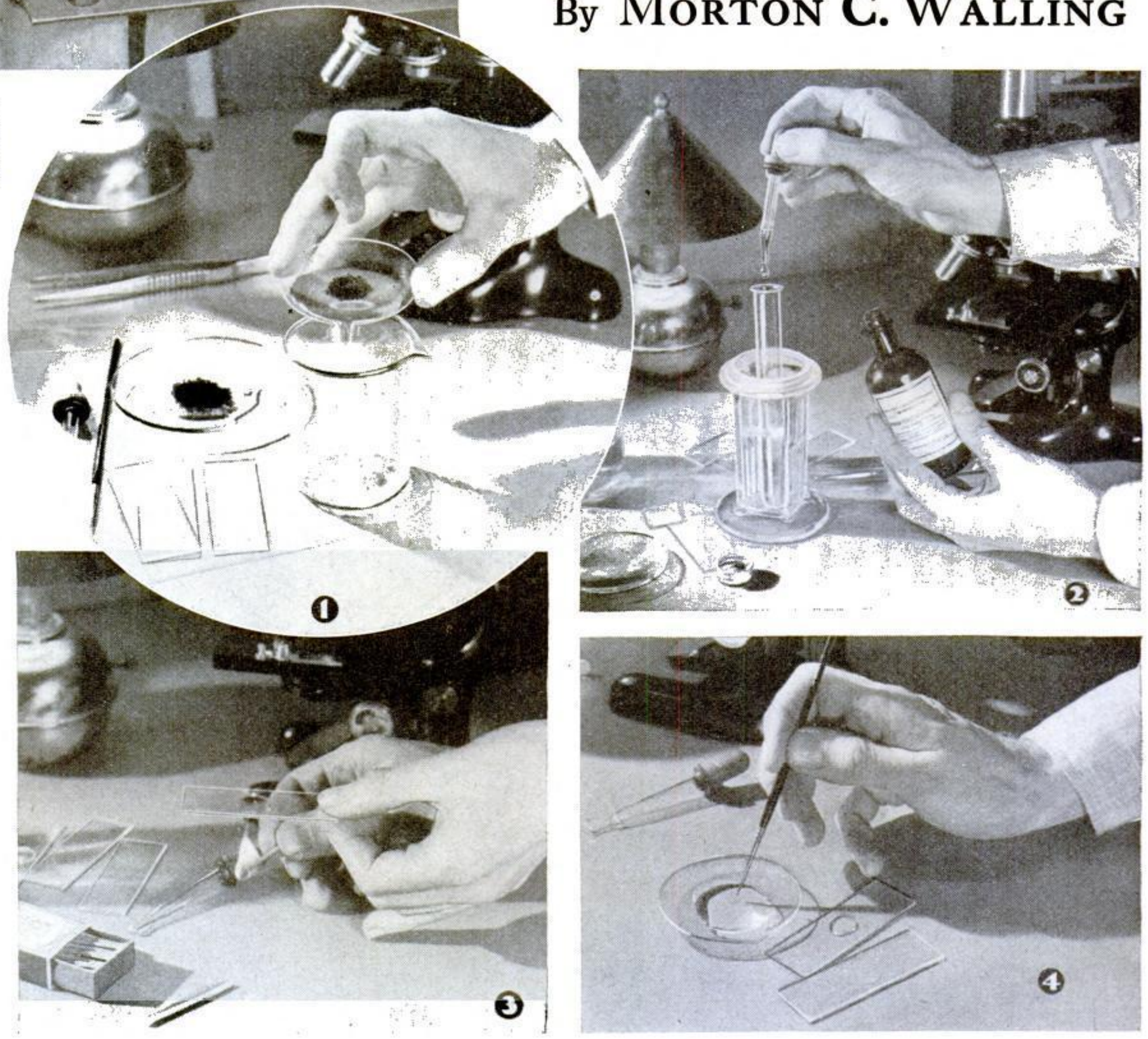
The vinegar eel or vinegar worm is perhaps one of the best-known nemas. It is visible to the naked eye as a wiggling, whitish line in most vinegar that contains a distinct sediment. Put a drop of vinegar thus inhabited on a slide, and lay a cover glass over it. Examine the eels with a low power, say twenty-five to 100 diameters. You will discover that the worms do not remain still for even an instant. They whip about constantly in the film of liquid between the two pieces of glass.

The vinegar eel, although an easy nematode to find, is

By MORTON C. WALLING



An expert of the U. S. Department of Agriculture studying nematodes through a special microscope. The head rest embodies a cast of the user's head



CAPTURING NEMAS AND PREPARING THEM FOR THE MICROSCOPE

1 Place some muddy water from a stream or pond bottom in a transparent dish and let it stand. After the particles have settled, pour off the water into a beaker

2 To put the nematodes to sleep, dissolve a few drops of chloroform in some water and transfer the worms to the solution with a medicine dropper or fine brush

3 Another way of killing nemas is to heat the water containing them by holding the microscope slide over a match or candle flame

4 Individual nematodes are easily moved from the shallow dish to the slide with a camel's-hair brush of the type used by artists

Dragons SEEN WITH YOUR MICROSCOPE

not very important when compared with others of its kind. Neither is it very ferocious-looking. Some of these tiny worms which greet the microscopist as he peers down his tube would make the mythical oriental dragon spit envious fire. Three horrible jaws which open and shut like the jaws of a lathe chuck, and which may be studded with tiny teeth; curved spines projecting out from the head in a startling manner; a body armored with ringed structures—these are a few of the dragonlike characteristics found in some nemas.

Nematodes living in fresh water and in the soil make excellent microscopic specimens because they require almost no preparation. Their bodies are so transparent that their internal organs are seen clearly. It is one of the marvels of nature that, in these tiny worms, there are a nervous system, digestive system, and most of the other organs that one would expect to find only in larger animals. Most of the color seen in fresh-water nematodes results from food eaten or from a coloring of the intestine walls.

TO OBTAIN a collection of fresh-water nemas, place in a watch glass or other shallow, transparent dish, a small quantity of mud or sand from a pond or stream bottom. Examine it with a hand lens, with the lowest power of your microscope, or with a dissecting microscope. Watch for the characteristic wriggling or wavy motion of the nemas, a motion which continues while the worms remain in the same place. With a medicine dropper or fine-tipped pipette, you can pick up these worms and transfer them to another watch glass. Then, with a needle or slender camel's-hair brush, and still using the dissecting microscope, you can pick up the individual nemas and place them in a drop of clear water on a microscope slide for close examination.

Another method is to place the water, containing sand and mud, in a test tube or beaker and stir or shake it thoroughly. Let it stand for a few seconds, until the heaviest sand particles have settled to the bottom. Pour off the muddy water carefully, leaving the sand behind. Most of the nemas will go with the water. Now let this water stand for three or four minutes in a beaker about four inches deep; then pour it off carefully, so as to leave a layer of sediment on the bottom. This sediment will be found to contain nematodes in great numbers, which can be captured and placed on a slide as already described.

FOR examination at low or moderate powers, ordinary one by three-inch glass slides, with cover glasses, can be used. But for high-power work, such as detailed examination with oil-immersion objectives, and when similar objectives are used as substage condensing lenses, two cover glasses are preferred by nematologists.

To prevent the cover glass from crushing the delicate bodies of the nemas as a result of capillary attraction, it is necessary to block it up. This is done by placing beneath it spacers consisting of strands of spun glass, or hairs plucked from a camel's-hair brush of the kind used by artists. Three hairs arranged in triangular fashion about the nemas will be satisfactory.

If you desire to see any details of the internal organs, you will have to do something to slow up or stop the incessant wriggling. This movement, incidentally, always takes place in an up-and-down direction. However, when you place the nematode between a slide and cover glass there is not enough room for it to wag its tail vertically, so it has to move parallel to the surfaces of the glass. Therefore, most microscopic views of nematodes show their sides.

To put a nematode to sleep or kill it, you can use water in which a small quantity of chloroform has been dissolved. Fill a test tube a third full of water, add several drops of chloroform, and shake the mixture. Then put the nema into this water. Instead of chloroform you can use ether, chloral hydrate, or any other narcotic or anesthetic. Even tobacco smoke bubbled through the water will serve.

Another way of killing nemas is to heat the water containing them by holding the microscope slide above the flame of a match, candle, or Bunsen burner, until motion ceases. The specimens can be examined immediately, or preserved indefinitely by fixing and hardening in a suitable solution such as Flemming's, bichloride of mercury, or four-percent formalin, and then treating them as follows:

After the fixing and washing of the *(Continued on page 96)*

Recording Microscopic Subjects With Paper and Pencil

THESE simple set-ups will help you in making pencil sketches of the interesting things you see with your microscope. At the right, a mirror suspended from a stand combines with a cover glass mounted on the eyepiece to superimpose the image of the paper over the field of view. In Fig. 1, below, the microscope is used as a projector with its tube horizontal, a mirror reflecting the image onto the paper for tracing. Fig. 2 shows a right-angle prism substituted for the mirror. In Fig. 3, the observer looks downward through a thin cover glass and sees an image of the microscopic subject laid over the paper, so that it can be easily traced. In addition to its value in recording the appearance of nematodes and other subjects that do not photograph easily, sketching helps to fix details in the memory, and develops habits of close observation. A good free-hand artist can work without these aids.

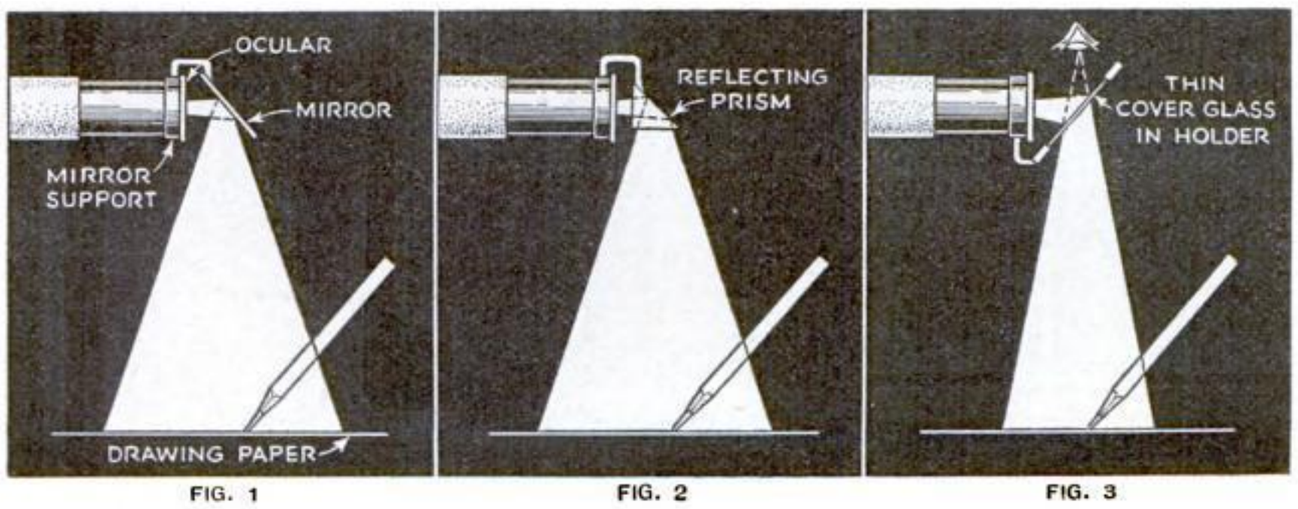
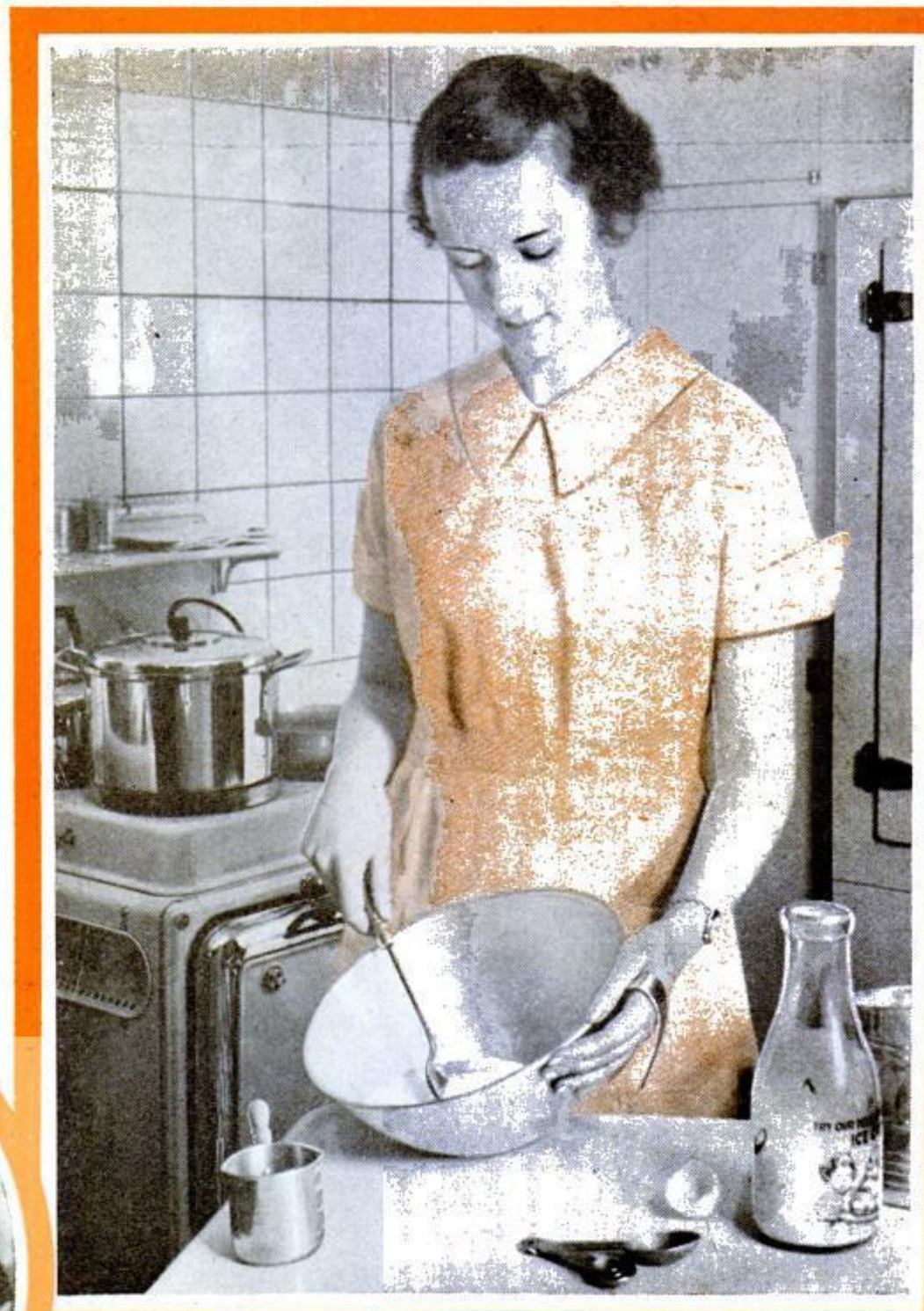


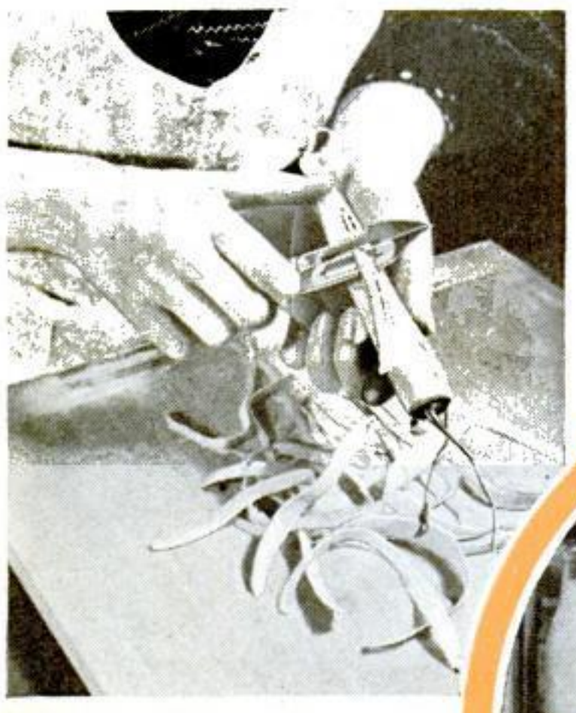
FIG. 1 FIG. 2 FIG. 3

Your vinegar jug probably contains eels like the one shown greatly enlarged at the right. The spots are air bubbles inside the skin

HOMEMAKERS' TASKS MADE EASIER BY NEW

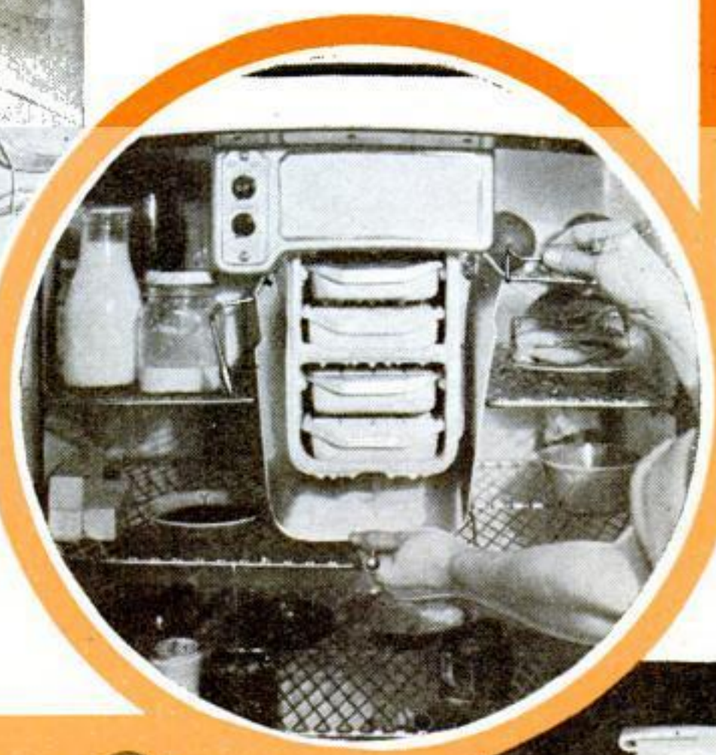
Household Utilities





NOVEL PARING KNIFE USES RAZOR BLADES

Discarded two-edged safety-razor blades of the conventional type provide the cutting edge for the peeler shown at the left, for fruits and vegetables



FROST ACCUMULATOR

A sheet-metal cover, made to fit around the cold unit of an ordinary electric refrigerator, accumulates the frost and can be removed easily for cleaning

MIXING BOWL **HAS HANDY GRIP.** Stamped from thick aluminum, this mixing bowl can be held securely in the hand

DUST CONTAINER. Dust from mops and vacuum-cleaner bags is safely shaken into the container pictured below. The vertical slot makes it possible to shake a mop up and down inside the container while it is closed—a rubber bumper clamping to the mop handle

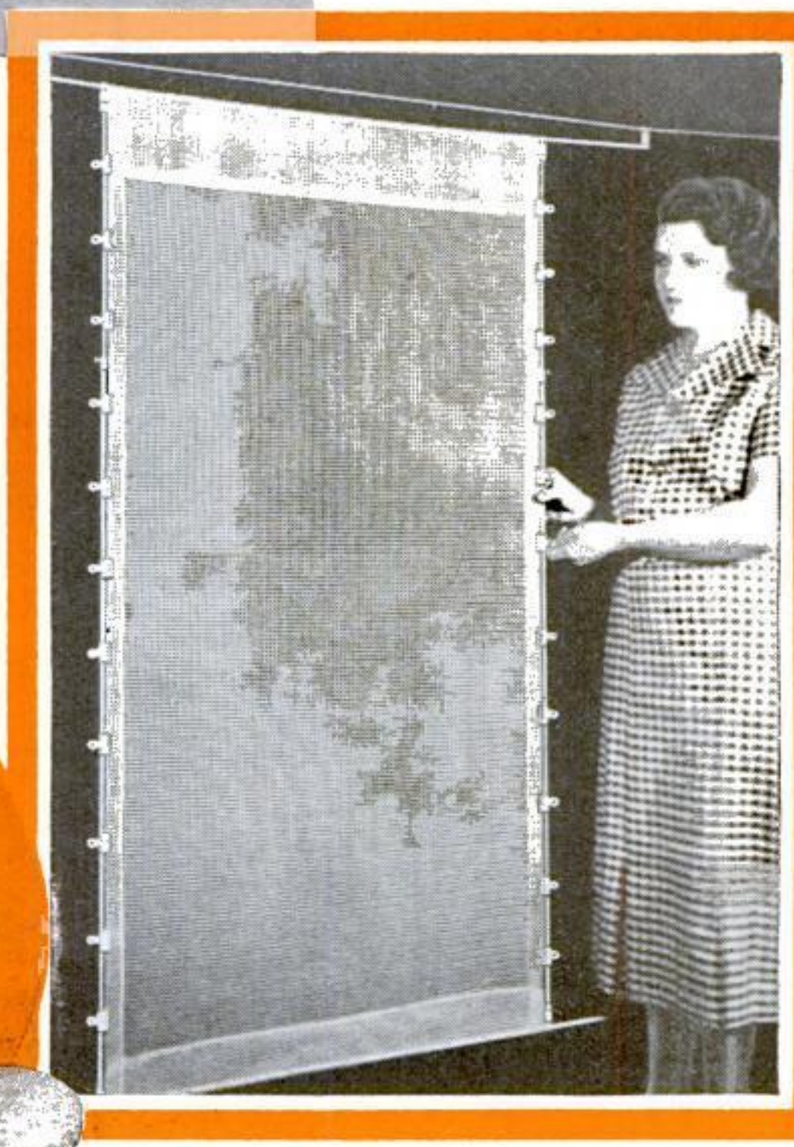
SCREW-CAP BOTTLE OPENER. Stubborn screw caps on bottles from half-ounce to gallon size are loosened by this tool

LEVER OPENS COUCH BED. At the pull of a lever, the lower part of this studio couch rolls out. A second lever raises this section to form a comfortable double bed

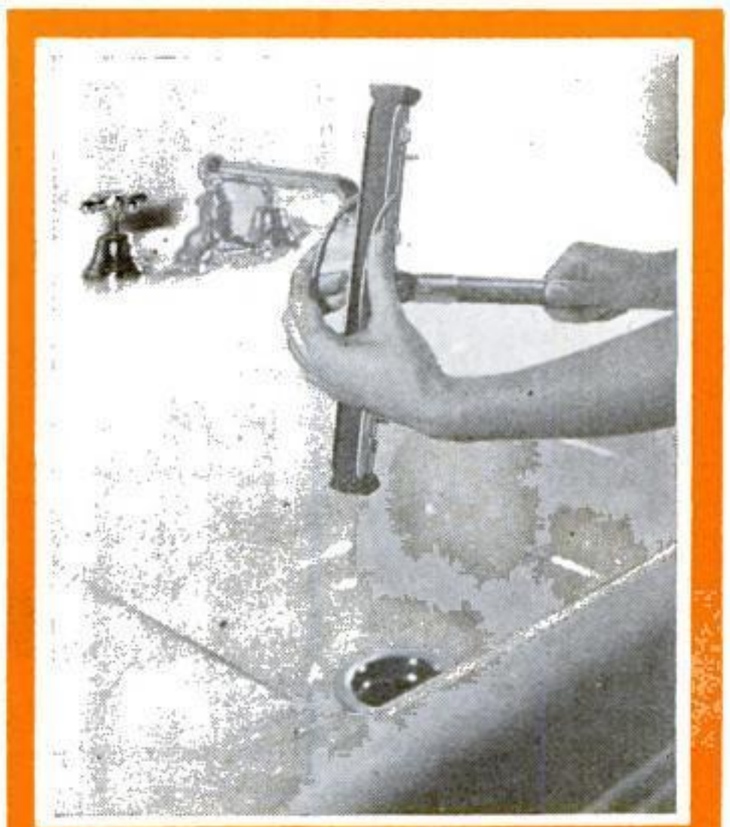
CLOTHES SPRAYER
Designed for use with modern, fast-heating electric irons, this automatic sprayer emits a fine spray when a button in its handle is pressed, to dampen laundry. The spraying is such that ironing can start at once

BEATER COMES APART
The usual mess of cleaning an egg beater is eliminated in the utensil at the left. The beating elements are removed from the frame for washing and easily reassembled

CURTAIN STRETCHER IS SAGPROOF. Rods and clamps at the sides of this simplified curtain stretcher keep the curtains from sagging, without the use of pins. Rod markings insure accuracy



CANAPÉ AND SANDWICH CUTTER
Uniform cuts of bread for canapés, sandwiches, and other delicacies are made by this easily cleaned, stainless-steel cutter. Sandwich paste may be spread on the cut before it is ejected from the core



STEPLADDER AND STRAIGHT LADDER COMBINED

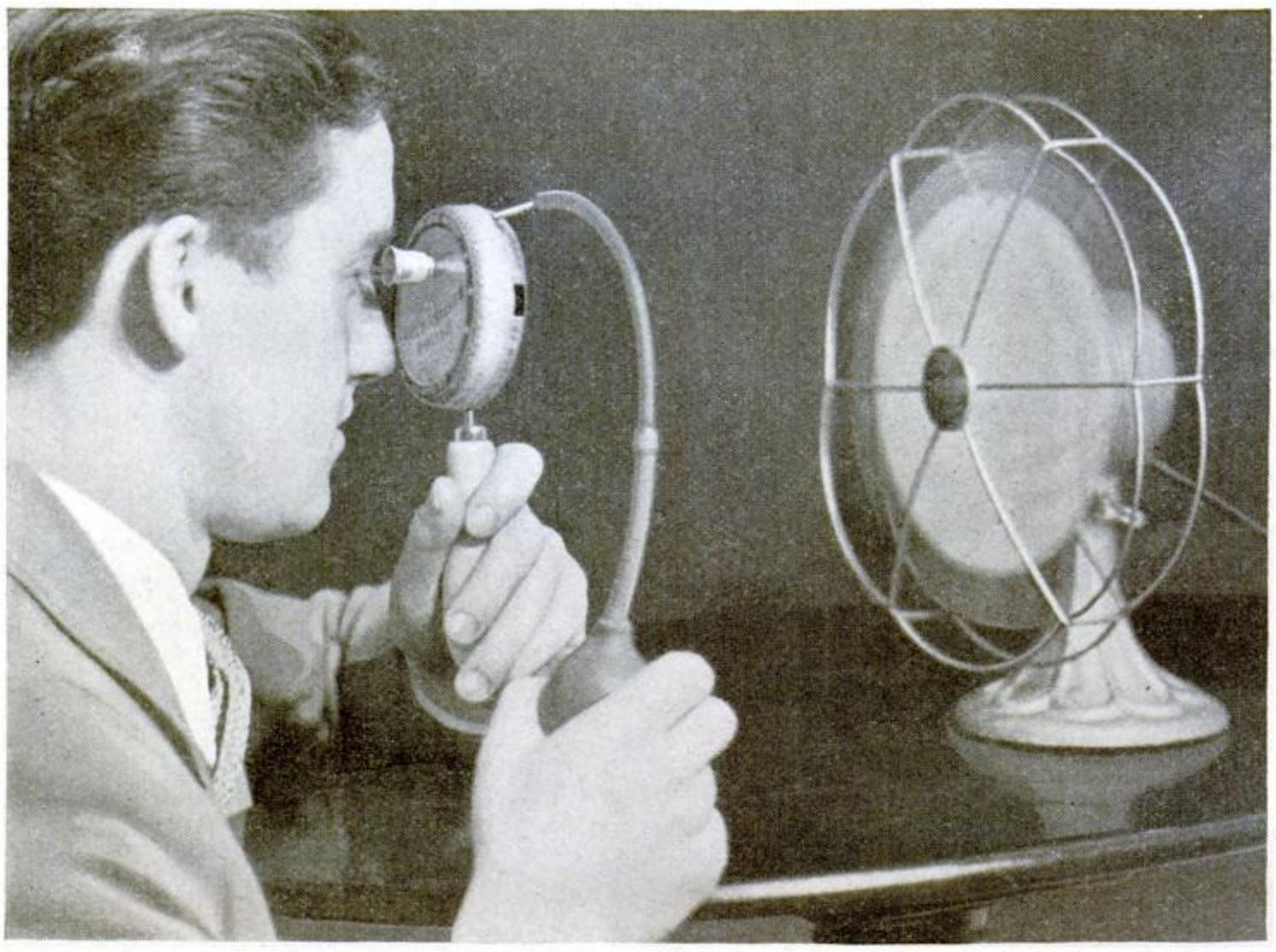
A simple adjustment converts this stepladder into a straight ladder for outdoor use, as shown at the right. A patent hinge holds it securely in either position, and rubber-shod feet guard against slipping. The lower part has trussed steps, and the upper part has hickory rounds. The platform is removable and can be placed in any position where it is needed

BRUSH AND MOP IN ONE

Cleaning jobs are simplified by this combination unit. When it is used as a mop, the rubber wiper is easily squeezed out by means of levers on the flanges, as shown above. With handle removed, it is a brush

Whirling Wheels

When Viewed Through HOMEMADE



This simple stop-motion device, driven by compressed air from an atomizer bulb, "freezes" rapid mechanical motions. Here it is being used with a disk of special design on an electric fan

This Article Tells How To Make and Use a Device That "Freezes" Machinery And Other Moving Objects For Interesting Tests

By
GAYLORD JOHNSON

EVEN the simplest device of modern science would look like black magic to our ancestors, if they could come back and see it work.

Imagine, for instance, the wonder which you could arouse in your great-grandfather's mind if you asserted that you could read a word chalked on the side of a rapidly whirling flywheel—and actually did read it! Yet this is a very simple feat to perform with the modern stop-motion device called a stroboscope, which today enables engineers to obtain "still" views of rapidly whirling and vibrating mechanisms and study them as if they were perfectly motionless, thus obtaining valuable clews to the solution of problems in lubrication and efficient machine design.

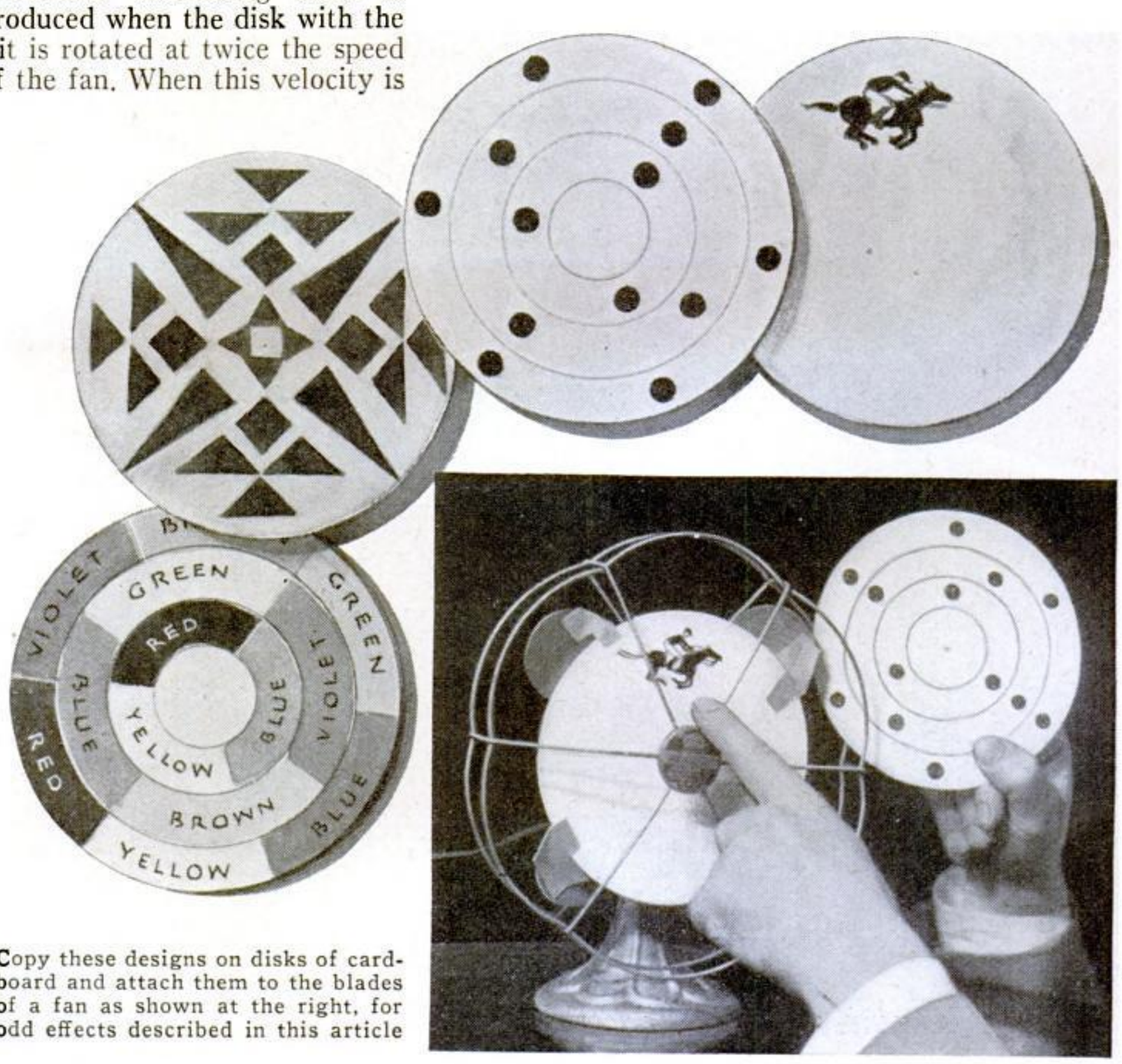
The principle of the stroboscope is so simple that it is easy to build one out of ordinary materials and carry out a wide variety of interesting and amazing experiments. All that is necessary is to make a disk in which a narrow slit is cut near the edge, and devise means for rotating it rapidly in a suitable housing provided with a viewing hole in line with the path of the slit. You look through the eyehole at a whirling electric fan, for example, and speed up the disk. When its rate of revolution becomes equal to that of the fan, the blades will appear to slow down and stop—just as if the current had been turned off! If a clipping with a few words of large type has been pasted on one of the blades, you can read it, although the fan is nothing but a blur to the unaided eye!

And you can not only "stop" the motion; you can even "reverse" it. If the speed of the stroboscope is increased to exceed that of the fan, the whirling blades will appear to be running backwards.

Another interesting effect is produced when the disk with the slit is rotated at twice the speed of the fan. When this velocity is attained, the fan will seem to slow down and stop as before. If the fan has an even number of blades it will appear quite normal; but if the number is odd, you will see twice as many blades. Similarly, if you have attached a picture (of a horse, let us say) to one of the blades, you will now see *two* horses motionless at opposite sides of the fan.

A moment's thought will reveal the principle which makes these surprising effects occur. It is called the "persistence of vision" and is the same principle which makes motion pictures possible. Here is how it works:

When the slit in the revolving disk crosses the eyehole through which you



Copy these designs on disks of cardboard and attach them to the blades of a fan as shown at the right, for odd effects described in this article

Stand Still

STROBOSCOPE

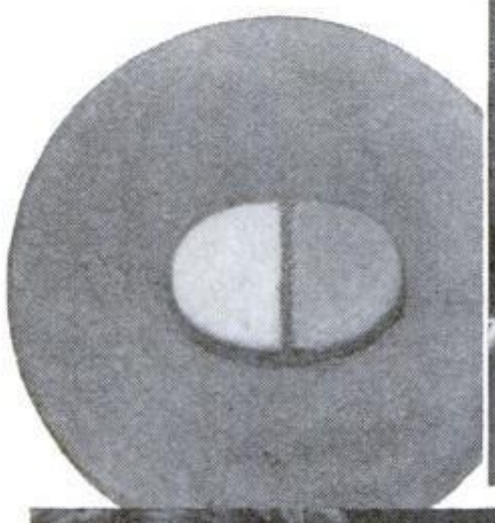
see the fan, you get a split-second, instantaneous view of the horse picture. This image remains on your eye's retina for a fraction of a second. When the disk is revolving at the same speed as the fan, you get a succession of glimpses of the picture at the same spot in its circular path, and these repeated impressions are blended by the persistence of vision into what looks like a steady picture of the horse at the same spot.

The appearance of *two* horses, when the disk's speed doubles that of the fan, is accounted for in the same way, except that you get two glimpses of the horse during each revolution of the fan, or one every half revolution. The doubled impressions accordingly produce two apparently motionless pictures of the horse at opposite sides of the fan.

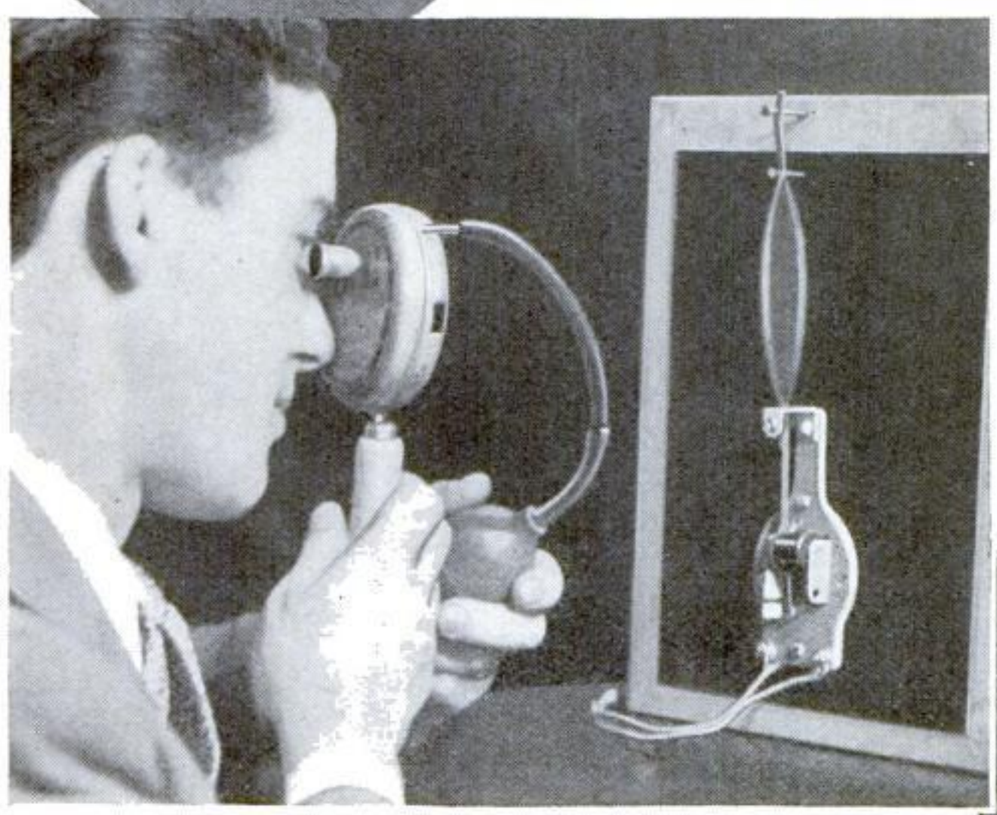
Now, having cleared up the principle upon which the stroboscope is based, we will consider a practical change which we must make in building our simple piece of apparatus.

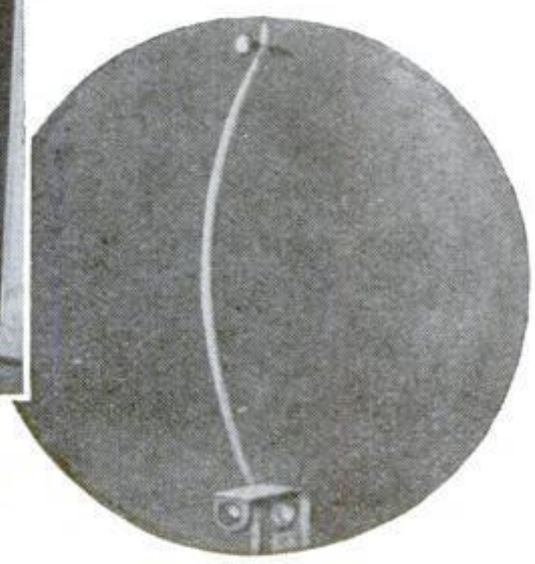
The motive power which we will use—compressed air acting on tiny "turbine" blades attached to the disk—is incapable of developing a speed equal to that of a fan run by an electric motor. We must resort to a trick to multiply the number of glimpses caught in each second. This can be done simply by cutting more slits in the disk! If we provide four slits instead of one, it amounts to the same thing as running the single-slit disk four times as fast, for we get four times as many glimpses of the horse every second.

For building your stroboscope, you will need only some sheet brass or heavy tin; the rubber bulb from an atomizer; a flat, round shoe-polish can and cover; a wood-

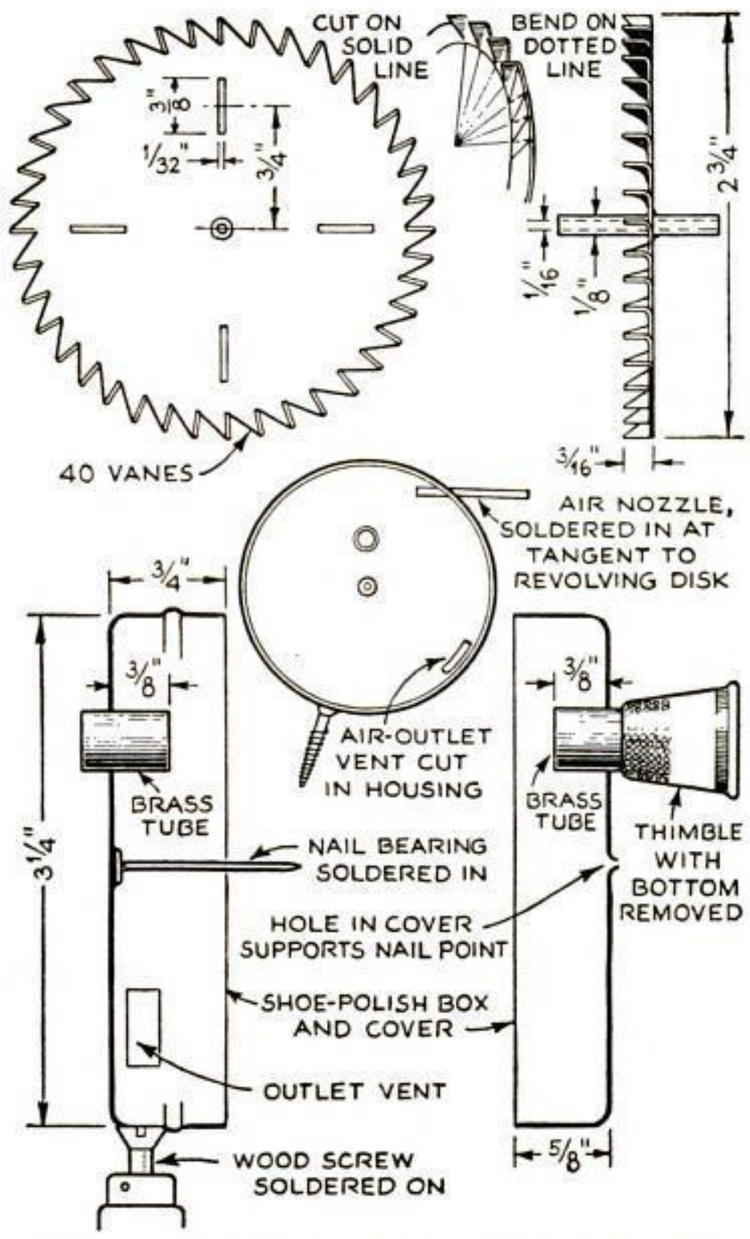


You can actually see the impulses of ordinary alternating current by looking at a glowing, plate-type neon lamp with your stroboscope. When the disk is rotating at the proper speed, one of the plates seems to be glowing continuously, while the other remains dark, as shown in the circle at left





A rubber band, attached to the hammer of an electric bell as illustrated, vibrates when the bell "rings." When viewed with the stop-motion device, it "freezes" in a curve as at right



A shoe-polish box, a rubber bulb, and a few other odds and ends are all you need to make this interesting device. The details of construction are shown in the photo and drawing

en file handle; a flat-headed wood screw; a bit of one-eighth-inch brass tubing; and a long, thin brad that fits loosely in the bore of the tubing.

If you find it difficult to obtain suitable tubing, you can roll up a piece of thin metal and run solder between its layers to make a solid tube with a bore of about one-sixteenth-inch.

If your shoe-polish box is not more than three and one-fourth inches in diameter, you will not need to alter the dimensions which the plan gives for the disk. Otherwise, modify the size of the disk sufficiently to bring its edge within about one-fourth inch of the rim of the box.

Cut the disk out of your sheet metal, and solder a piece of the tubing through its center as a bearing to run on the nail. When the vanes are cut and bent on the edge of the disk, and the four slits cut to the dimensions indicated, the moving part of the device is complete. It should spin freely and evenly on the nail, which must be soldered firmly at the center of the blacking-box housing.

Now punch a hole in the edge of the box and solder the air tube in position as shown in the plan. It should be approximately tangent to the edge of the rotating disk, so that the jets of air forced out by the atomizer bulb will strike strongly upon the vanes to propel the disk.

Then cut an *(Continued on page 106)*

Organic

Making Real Test Papers, And Preparing Substances For Odd Chemical Stunts, Serves To Introduce You To the Fascinating Field Of the Carbon Compounds

By Raymond B. Wailes

Large flakes of "artificial snow" rise and float in the air when a hot soldering iron is thrust into a shallow dish or can lid containing metaldehyde, a powdery organic chemical

ARE you an amateur chemist looking for something new to try in your home laboratory? If so, you will enjoy a little venture into the realm of organic chemistry.

Most of the chemicals on your shelves —for example, common salt, copper oxide, magnesium chloride, and sodium silicate—are inorganic, or of mineral origin. Chemicals produced by plant and animal life have become known, in contrast, as organic. Because synthetic chemistry has produced many of the latter without the aid of nature, a preferable definition of organic chemistry is simply to call it the chemistry of the carbon compounds, of which there are thousands.

One of the most curious is a powdery organic chemical called metaldehyde. Thrust a heated soldering iron or a hot poker into a dish of this material, and flaky white particles, some as large as hens' eggs, will rise into the air and float there. The stunt is a good one for parlor entertainment; you can describe the display as "artificial snow" or "frozen smoke."

In a variation of this trick, some of the powder is compressed and concealed in an electric cigar lighter. Whoever starts to use the lighter will get a surprise as the glowing element volatilizes the chemical and the white particles fill the air.

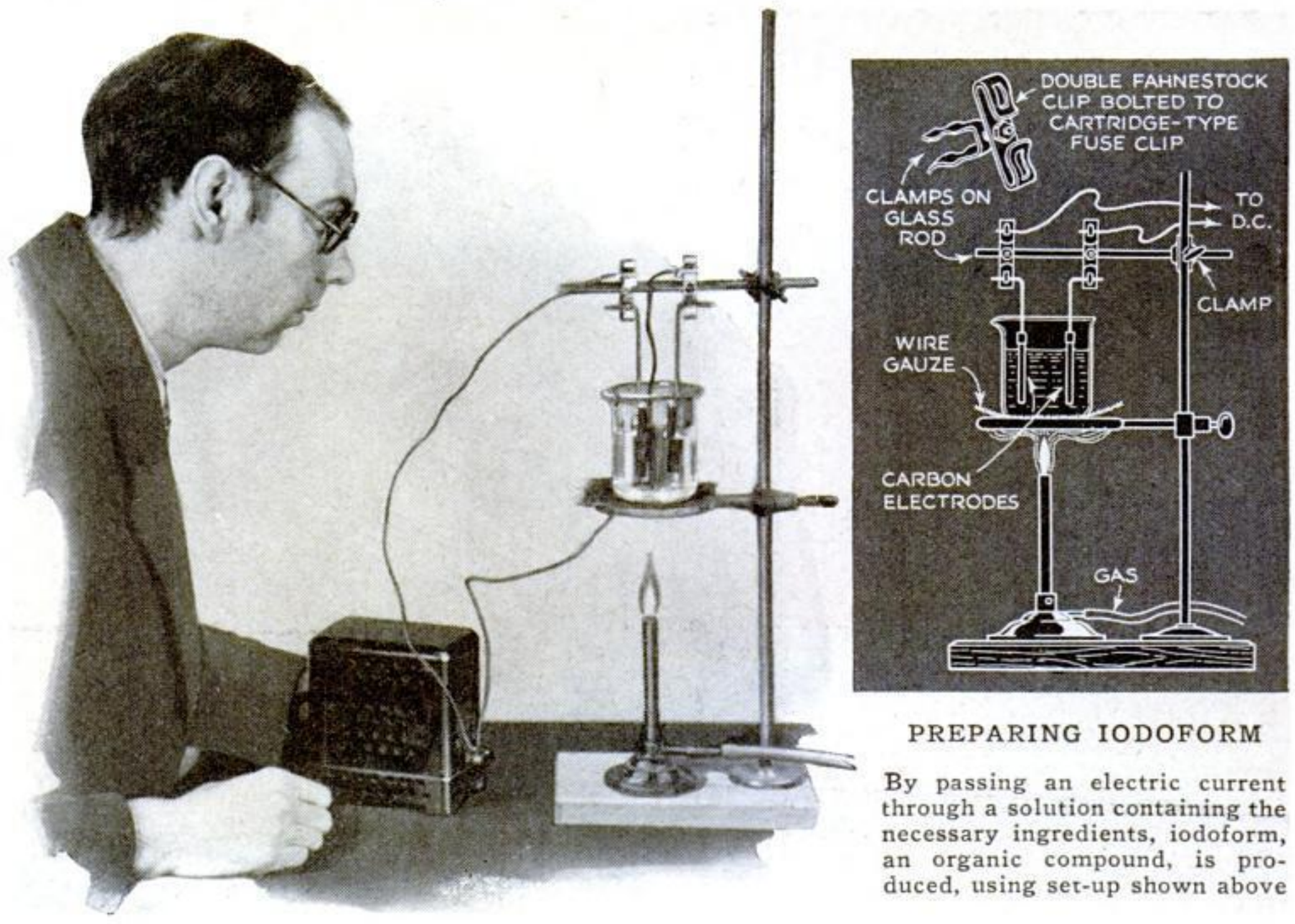
The "magic" in either case is easily explained. Metaldehyde does not melt when it is heated, but sublimes, or turns directly to vapor which in turn immediately solidifies as it is cooled by the air; the silky structure of the solid accounts for the size of the flakes that are formed. If the substance is overheated, it takes fire, burning quietly with a blue flame like that produced when alcohol is ignited.

Most dyes are organic chemicals. Among these are the chemical indicators that show you whether a liquid is acid or alkaline, such as litmus, phenolphthalein, and methyl orange. You can make your own indicators with materials that nature conveniently provides at this season of the year, for flowers contain coloring substances that possess the desired properties.

Steep hollyhock flowers—preferably blue ones—in warm water, and you will obtain an extract of their coloring matter. Add a little acid to this, and it will turn red. If an alkali such as lye or soda is added instead, the liquid will turn bluish green. Nearly all flowers whose blooms are of dark blue or purple color show similar properties.

Blossoms that you can use for preparing such indicators include iris, dahlia, stock, petunia, and rose of Sharon. The leaves of red cabbage, too, will yield an extract that changes color as it reacts to acids or alkalies.

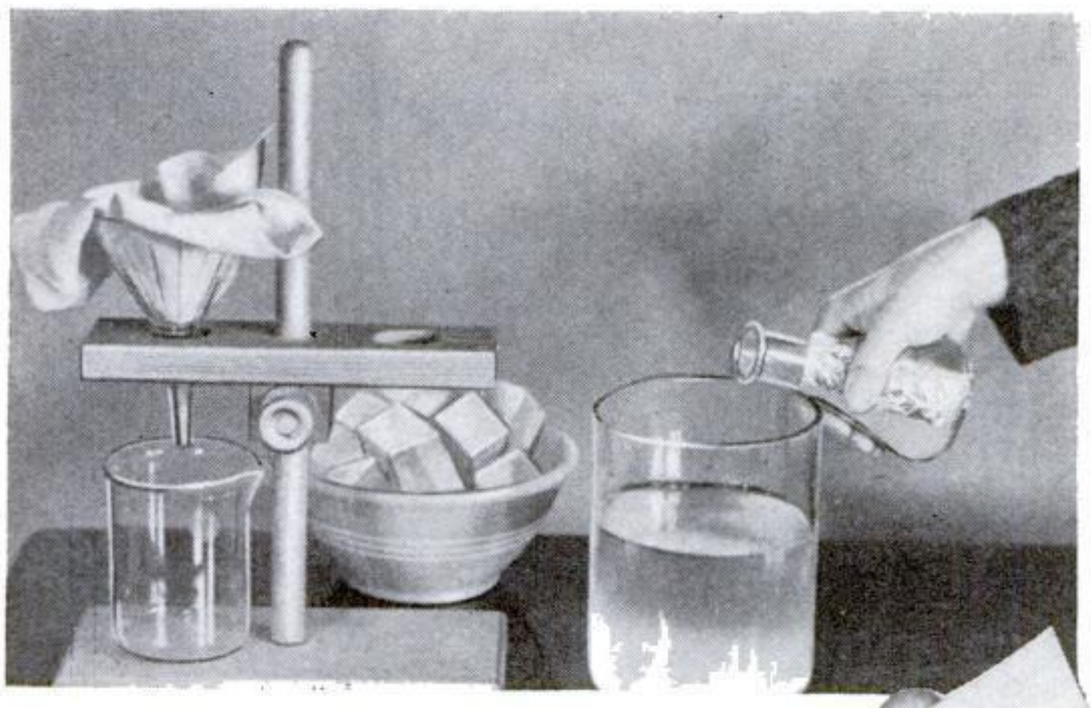
Another indicator is turmeric, which can be purchased as a powder at many grocery stores; it is sometimes used as an ingredient in the condiment curry. Steep some of the powder in warm water. White paper, dipped in the resulting solution, retains the coloring matter. It may be dried, cut into strips, and kept in bottles for use as test paper. Solutions of boron compounds, such as borax, may be identified with the strips. When such a solution is made acid, and yellow turmeric paper is dipped into it, the paper will turn red. The color is intensified by drying. If the same test strip is then dipped in ammonium hydroxide, or common household ammonia, it will turn blue. The first color



PREPARING IODOFORM

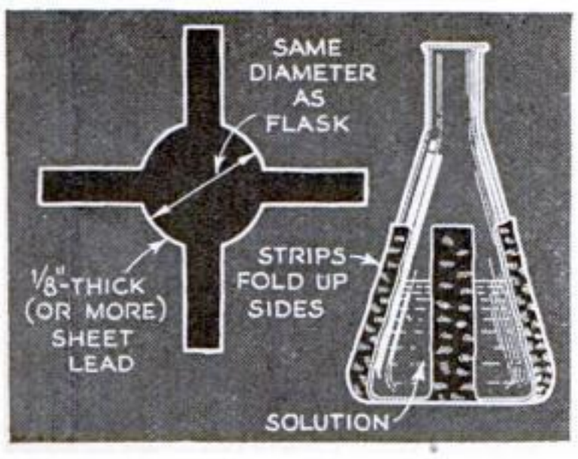
By passing an electric current through a solution containing the necessary ingredients, iodoform, an organic compound, is produced, using set-up shown above

Chemistry FOR THE HOME EXPERIMENTER

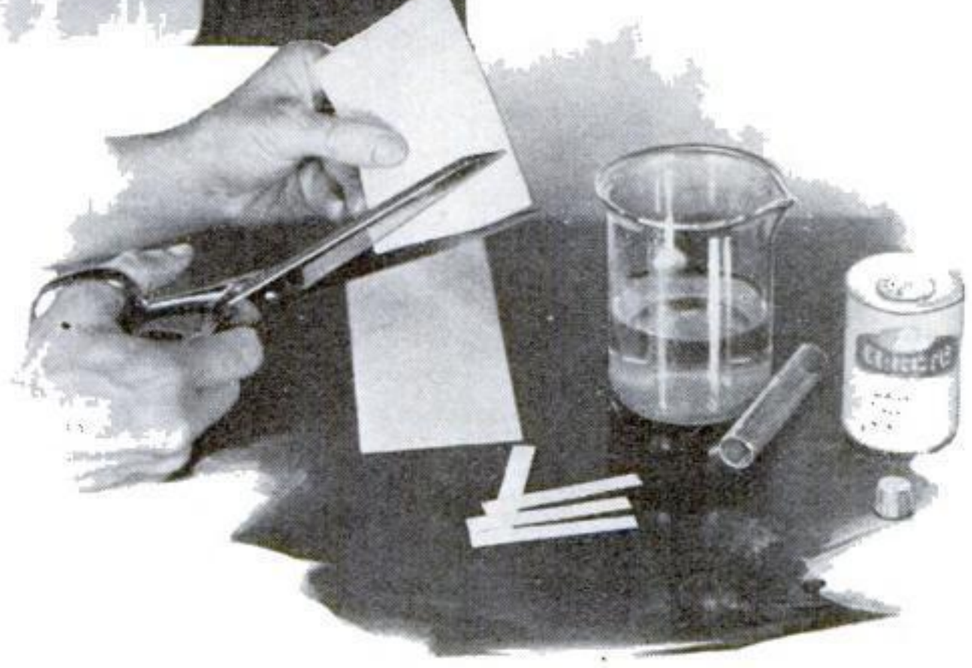


Paranitroacetanilide, used in the "Pharaoh's serpents" fireworks stunt, being prepared by dropping a solution into iced water. The cloth and the funnel are for filtering

You can make your own test papers for determining whether substances are acid or alkaline. Below, strips are being cut for saturation with turmeric, an "indicator" that is sold in grocery stores as an ingredient for curry



How to weight a flask with lead to keep it submerged in ice water for chilling contents, as in the experiment above



change is a test for boron, and the second color change confirms its presence. If a known solution of a boron compound is used, the second color change may be used as a test for ammonia.

Some organic compounds, like many inorganic substances, can be prepared by electrolysis—that is, by passing an electric current through a solution containing the raw materials. One of these is iodoform, an organic chemical containing iodine, which is useful as an antiseptic.

To do this on a small scale, dissolve about five grams (one teaspoonful) of potassium iodide and ten grams of sodium carbonate (washing soda) in ninety cubic centimenters of water (an ordinary drinking glass holds about 240 cubic centimeters). Then add about ten cubic centimeters of alcohol. If pure ethyl or grain alcohol is not available either ordinary rubbing alcohol or acetone may be substituted.

When this solution is placed in a beaker and an electric current is passed through it, iodoform is produced. Its characteristic odor is readily detectable. Heating the solution to between sixty and seventy degrees centigrade, while electrolysis is in progress, will greatly increase the quantity formed. After electrolysis has proceeded for about fifteen minutes, you can recover the iodoform by filtering the liquid.

Carbon electrodes should be used in the experiment just described, since terminals of metal would form objectionable metallic iodides. Rods of carbon taken from old flash-light cells will serve the purpose well. They can be supported conveniently by soldering heavy wires to their brass caps. The necessary supply of direct current may be provided by two or three dry cells, connected in series. Alternating current is unsuitable, but the pulsating current from a rectifier of the type used in charging storage batteries may be employed to good advantage.

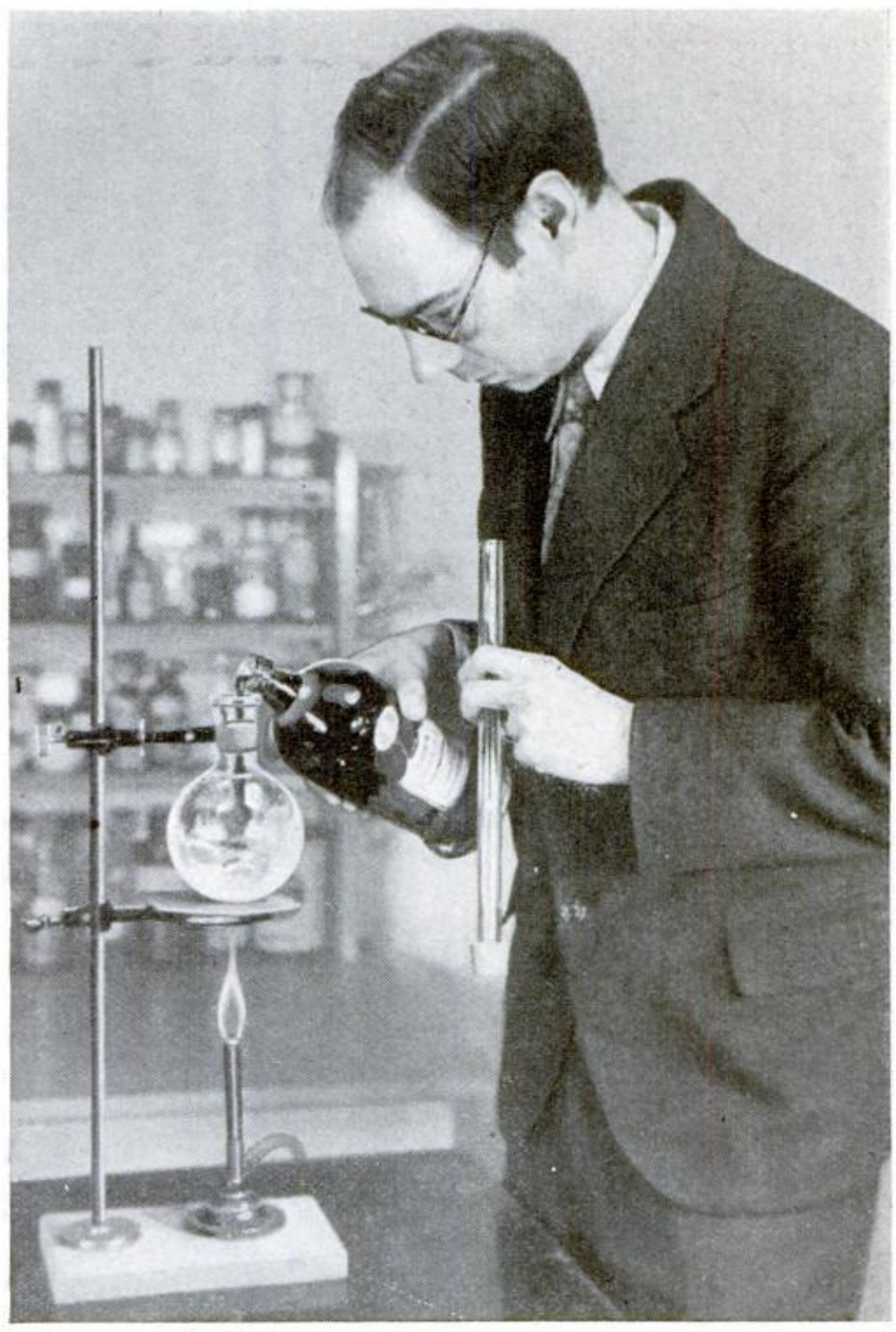
A favorite chemical experiment consists of placing zinc rods or strips in a solution of lead acetate, and observing the treelike growth of crystals that occurs within a few days. The lead acetate used for this purpose is an organic compound, and its preparation affords an interesting exercise in laboratory methods of organic chemistry.

Place some lead monoxide (also known as litharge) and some acetic acid in a round-bottomed flask. By means of a cork at its mouth, attach a water or air-cooled condenser in a vertical position. Then start heating the contents of the flask.

As the heat drives off vapors of acetic acid and of water, they pass up the neck of the flask, and would escape but for the condenser that you have set up. Here they are condensed, and the resulting liquid falls back into the flask where the reaction with the lead monoxide is proceeding. This operation is known as "refluxing," and prevents the loss of the raw materials during the heating that assists the reaction. A condenser used in this way is known as a "reflux condenser."

When you have refluxed the mixture of acetic acid and litharge for about half an hour, a considerable quantity of the latter should have been converted into lead acetate. Cool the solution and filter it. The filtrate, or liquid that passes through the filter, consists of a lead acetate solution together with some unchanged acetic acid. If you allow it to crystallize, you will obtain the lead acetate in solid form. The liquid, however, may be used as it stands in experiments calling for lead acetate solution, and may be bottled, labeled, and kept for the purpose.

The reflux condenser used in this experiment may be nothing more elaborate *(Continued on page 105)*

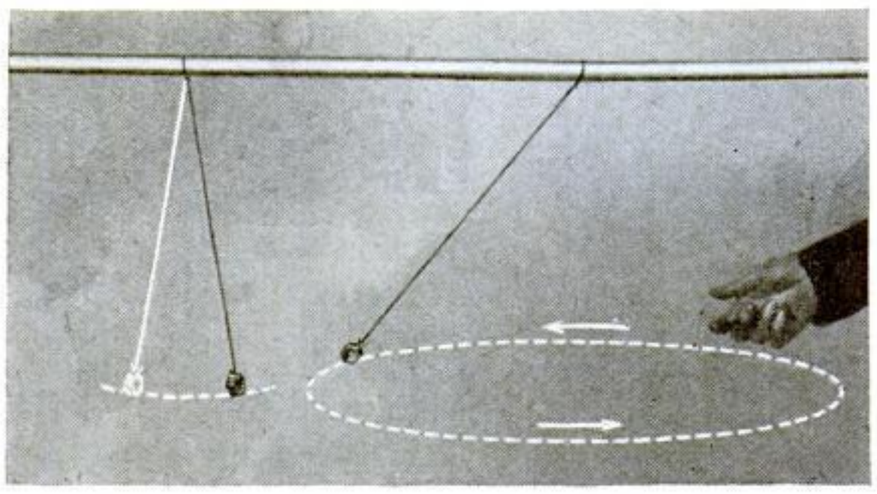


REFLUX CONDENSER. The apparatus being used here for making lead acetate from litharge and vinegar, is also employed in making acetanilide and in a number of other "refluxing" operations

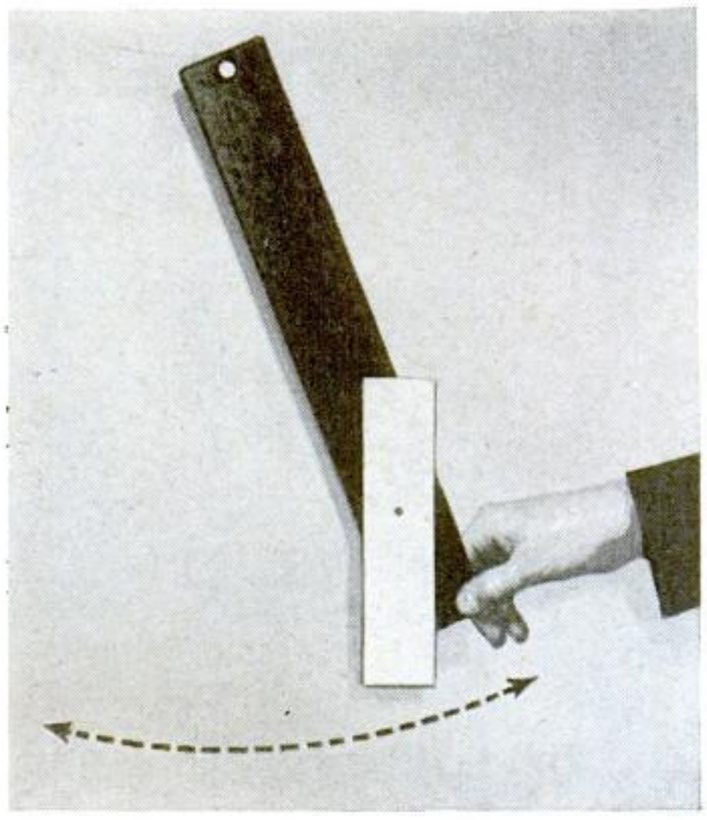
ANYONE CAN PERFORM THESE

Science Stunts

Making Two Pendulums Keep Time



PENDULUMS of different lengths will have the same periods of oscillation, so long as their weights are swinging at the same level. In this experiment, the pendulum at the left is allowed to swing back and forth in the ordinary manner, while the longer one at the right is operated as a "conical pendulum"—that is, swung in a circle as indicated by the dotted line. When the path of the conical pendulum is at the same level as the arc of the other, the two will complete their swings in exactly the same period of time, despite the greater distance traveled by the former.



Small Pendulum Acts as Brake On a Larger One

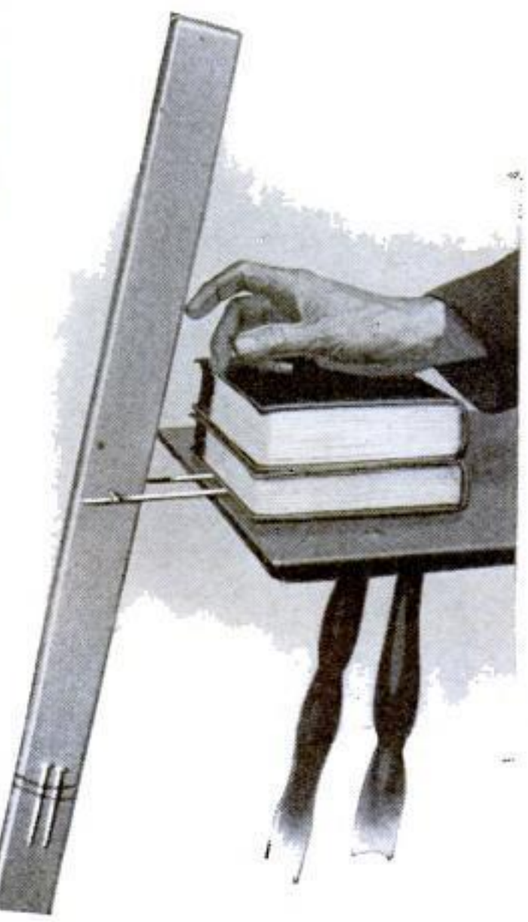
MAKE two pendulums of thin wood or cardboard and mount them as illustrated in the photograph, with the smaller one pivoted on the larger and so balanced that the two have the same periods of oscillation, that is, complete their swings in the same time. Start the large pendulum swinging, and the motion will be taken up and "damped out" after comparatively few swings by the smaller one. If the latter is clamped tight, so that it cannot swing, the large one will swing ten or fifteen times as long. The "braking" is due to energy being spent in friction by the small pendulum.

Sound Traces Patterns in Sand

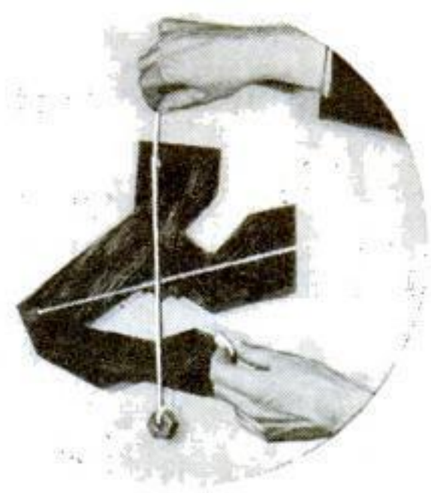
WITH this simple apparatus, you can actually "see" your own voice, as the sound vibrations shake particles of sand into strange geometrical figures. Make a hole about two inches in diameter in the side of a cylindrical cardboard box. Stretch a piece of rubber from a toy balloon over the open end of the carton and sprinkle some fine sand on the diaphragm so formed. By speaking into a mailing tube, direct your voice through the hole in the side of the box. As the diaphragm vibrates under the impact of the sound waves, the sand assumes striking patterns, a principle used in telephone transmitters with carbon particles in place of the sand.

Compound Pendulum Swings in "Slow Motion"

TO MAKE a pendulum that swings very slowly, drive two nails into the center of a board about two feet long, one on either side, to form a pivot. Rest the nails on two stiff pieces of wire, as at right, and adjust the balance by means of a small sliding weight like the nails held on by a rubber band. The more nearly the two ends balance, the slower the pendulum will swing. As few as three swings a minute are possible.



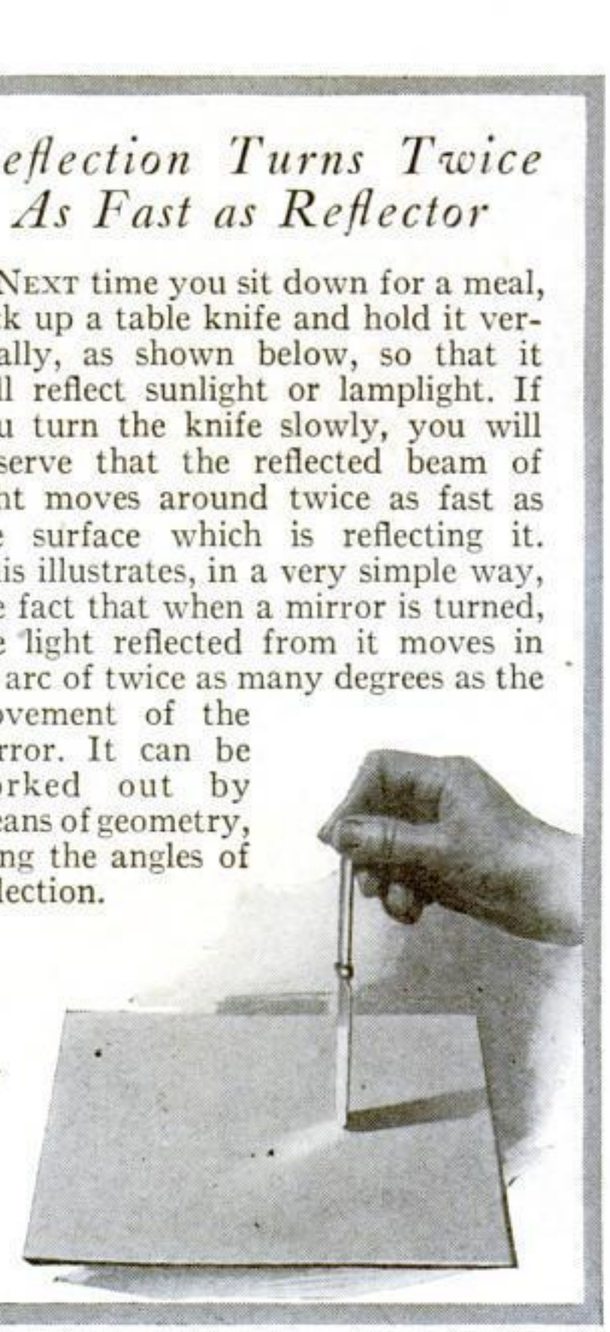
Finding the Center of Gravity

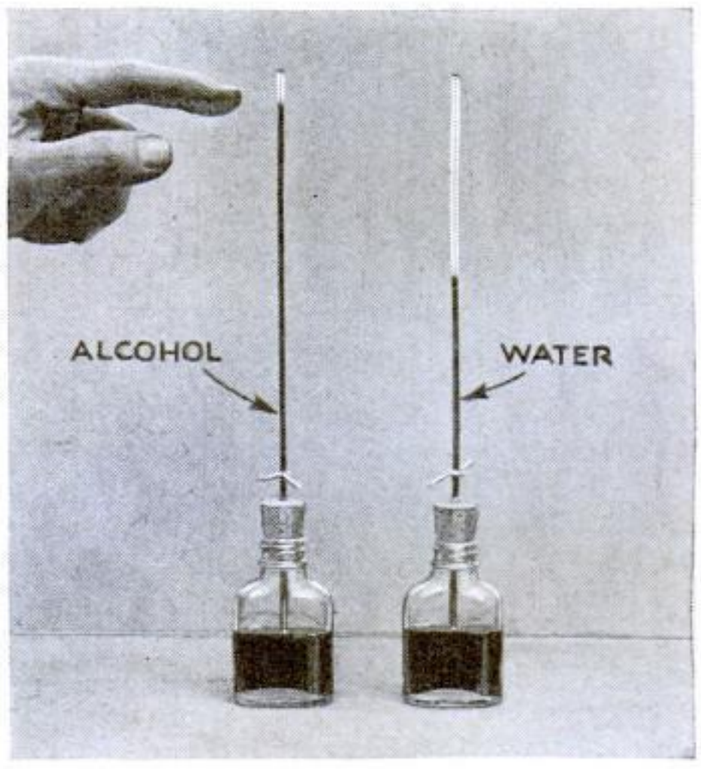


THE center of gravity, or point where all parts balance each other, can be found in a piece of cardboard of any shape by suspending it so it hangs freely on a nail. Hold a plumb line against the nail, draw a line along it on cardboard, repeat with another point of suspension, and where lines cross is the center of gravity.

Reflection Turns Twice As Fast as Reflector

NEXT time you sit down for a meal, pick up a table knife and hold it vertically, as shown below, so that it will reflect sunlight or lamplight. If you turn the knife slowly, you will observe that the reflected beam of light moves around twice as fast as the surface which is reflecting it. This illustrates, in a very simple way, the fact that when a mirror is turned, the light reflected from it moves in an arc of twice as many degrees as the movement of the mirror. It can be worked out by means of geometry, using the angles of reflection.





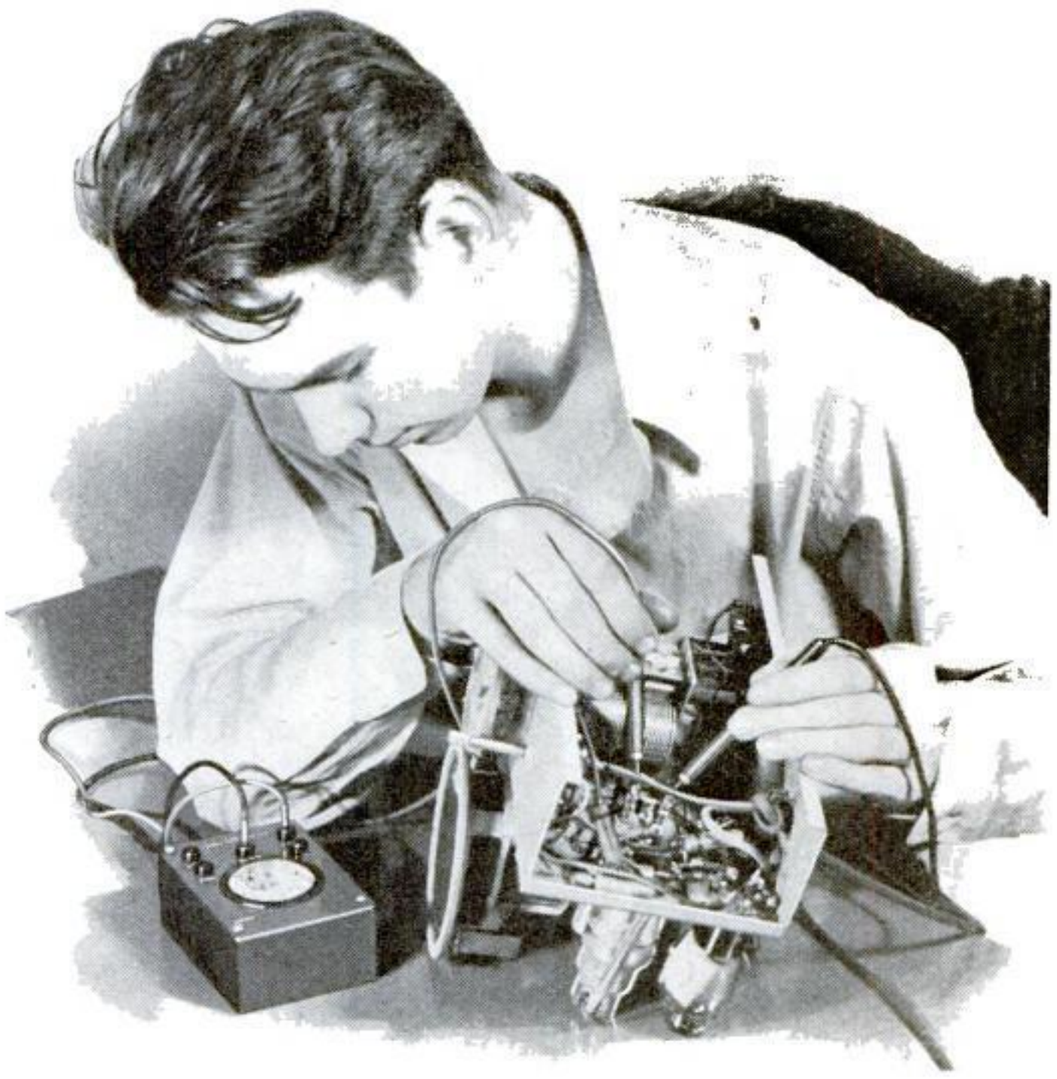
Easy Test Shows Difference In Vapor Pressures

ALTHOUGH the two bottles illustrated above originally contained equal amounts of air, when they were warmed about fifteen degrees F., the liquid column in the one containing alcohol rose much higher than that in the one containing water. This is because the alcohol has a higher vapor pressure, so that more of it evaporates under the influence of heat, and thus helps the expanding air to push up the column of liquid.

Useful Hints for Radio Fans

Pocket Meter Tests Resistances and Voltages

For experimental tests and trouble shooting, the amateur set builder will find the inexpensive tester illustrated at the right a handy addition to his tool kit. Small enough to fit a coat pocket, the combination meter measures either resistances or voltages. It provides four direct-reading scales—one for resistance (0 to 2,000 ohms), and three for voltages (0 to 5, 0 to 250, and 0 to 750). The outfit comes complete with flexible test leads and convenient changeable-tip test prods.

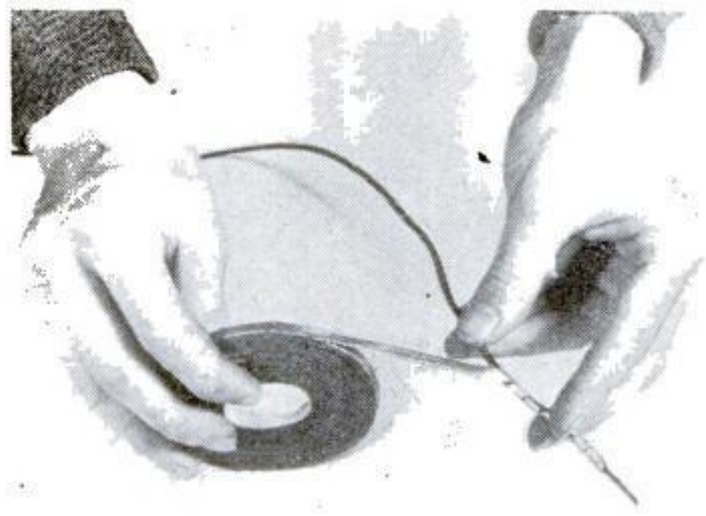


Low-Loss Coil Varnish Gives Insulating Coat

You can now provide your home-made coils, chokes, and transformers with a protective insulating coating by making use of a new low-loss coil varnish. Applied either with a brush or by dipping, as illustrated at the left, the material dries quickly in the air and requires no baking to harden it. Coated on the coils, the varnish also serves the purpose of a cement to hold the turns of wire firmly in place.

Flexible Metal Tape Shields Circuit Wires

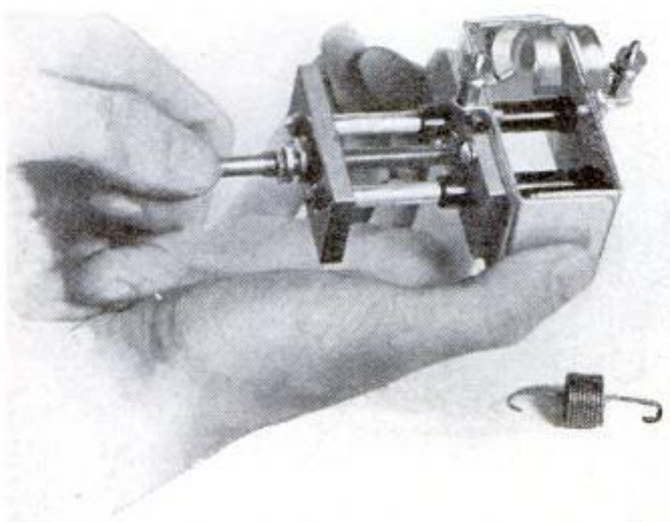
A new flexible metal shielding makes it easy to cover existing wires efficiently without removing them from the circuit. Provided with an adhesive surface, the shielding is simply wrapped around the wire like friction tape. Waterproof and corrosionproof, it is supplied in continuous fifty-foot rolls, and can be made to serve as an indoor antenna, its adhesive surface making the use of nails unnecessary.



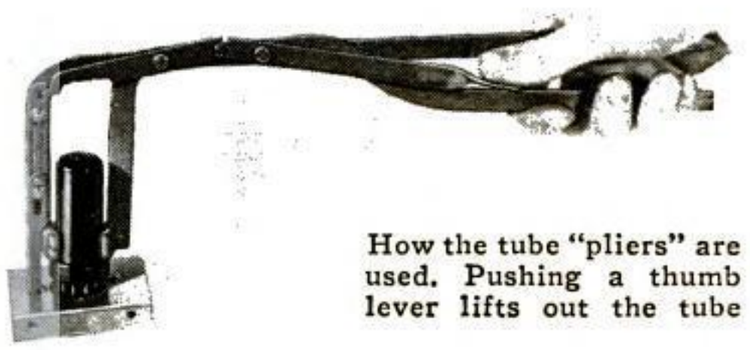
New Hand Tool Removes Tubes With Safety

Resembling a giant pair of pliers, a recently invented hand tool makes it easy to remove a metal tube from the crowded innards of a modern radio set. Its tong-like claws are placed around the base of the tube, the two hand grips pressed together, and a convenient thumb lever pushed down. Pressure on the hand grips holds the tube, while the thumb lever operates a sturdy metal finger that gently lifts the tube from the socket. The extractor also solves the problem of handling hot tubes.

Springlike Coils Give Variable Tuning



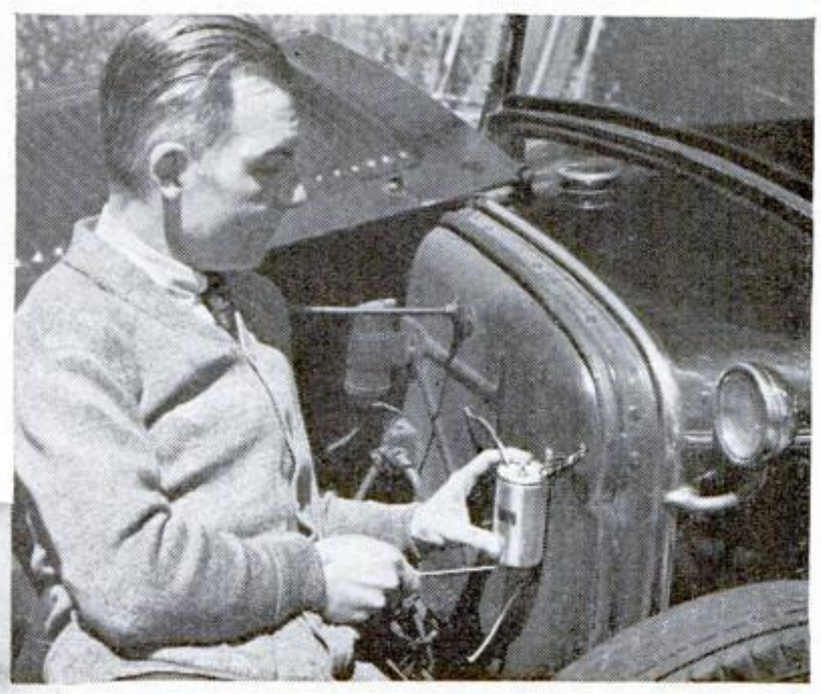
Made up as coiled springs, the latest in coils designed for use on the ultrashort wave lengths below ten meters, provides a variable means of tuning. Mounted between two movable terminals, the interchangeable units can be lengthened or shortened simply by turning the adjusting knob. Stretching and compressing alters their inductance to provide a variation in frequency range, from 1¼ to ten meters.



How the tube "pliers" are used. Pushing a thumb lever lifts out the tube

Pliers for Tight Quarters

Saw-tooth jaws, narrow nose, and slip-joint adjustment make these midget pliers a handy tool for radio experimenters. They will do the work of five or six sizes of fixed wrenches and are particularly useful for adjusting small knurled nuts and hard-to-get-at mounting bolts. Despite their small size and thin handles, they are very strong and serviceable and permit the user to get a bulldog grip on the work.



No spark-plug suppressors are needed when this noise filter is used with a car radio receiver

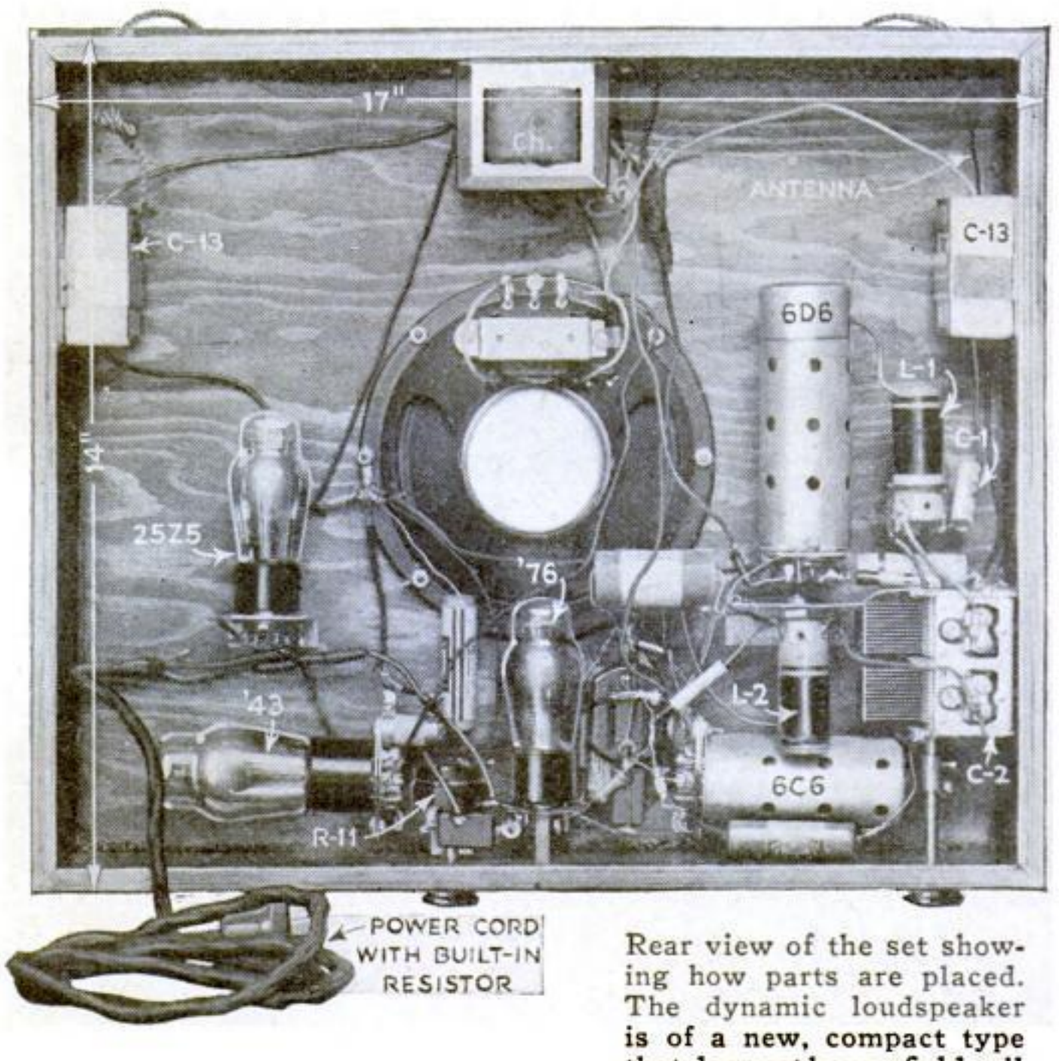
Noise Filter Balances Engine Interference

Spark-plug suppressors can be entirely eliminated if the antenna for your car radio is equipped with the easily installed noise filter at the left. By means of a short auxiliary antenna, the device deliberately picks up the spark interference from the engine's ignition system and matches it against the motor noises picked up by the actual antenna. In the matching process, the two sources are balanced against each other in such a way that one neutralizes the other. This procedure, known as phase inversion, supplies the receiver with a noise-free signal.

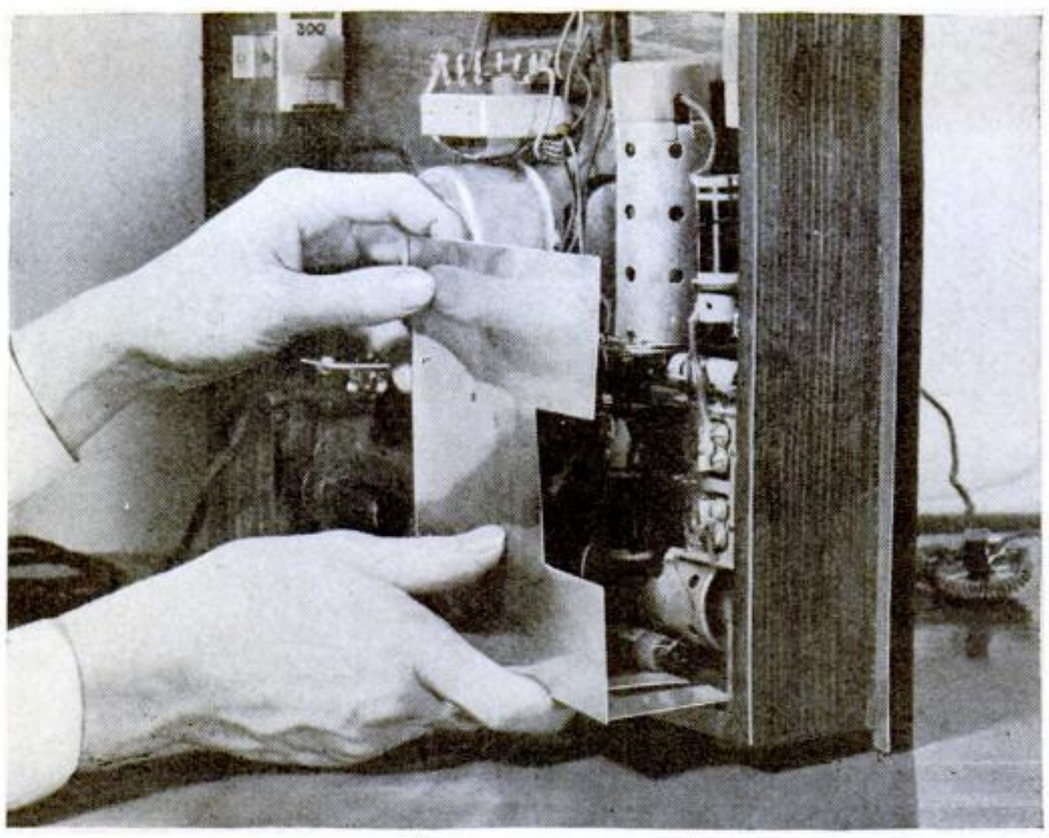
Make a Picture-

Efficient All-Electric, Five-Tube Broadcast Receiver Hides Behind a Framed Tapestry

Hung on the wall, this radio is out of the way yet always within easy reach



Rear view of the set showing how parts are placed. The dynamic loudspeaker **is of a new, compact type that does not have a field coil**



A sheet of aluminum shields the radio-frequency and detector stages

CLEVERLY disguised as an attractive picture, this novel homemade radio set can be hung on your wall. To all appearances, it is simply a framed piece of decorative tapestry supported by a gilt picture cord. Yet, its three-inch depth hides an efficient all-electric, five-tube broadcast receiver—loudspeaker and all.

Even the antenna lead-in is concealed. Running up through the braided-silk picture cord, it can be connected easily to an indoor antenna hidden behind the picture molding. The power cord also can be hidden by providing a wall outlet directly behind the frame. If this is impractical, the cord can be painted white or cream and partly concealed by running it down the corner of the room to an existing outlet in the baseboard.

Despite its compactness, however, the circuit is anything but crowded. As a matter of fact, a ten-tube set could easily be housed in the same space without difficulty. The parts are well spaced to simplify both the wiring and the placing of condensers, resistors, and tubes.

As indicated in the diagram, the circuit consists of a single tuned radio-frequency stage (6D6), a tuned detector (6C6), two resistance-coupled audio stages ('76 and '43), and a half-wave rectifier (25Z5). Since the circuit is designed to operate on either alternating or direct current, the familiar built-in-resistor power cord is used to supply the correct voltage to the filaments of the tubes. For a line voltage of from 105 to 120 volts, this resistance should have a value of 165 ohms; for 220 volts, a value of 570 ohms.

All parts used in the set are standard. The coils (L_1 and L_2) are ordinary high-gain units of the type used in commercial midget AC-DC receivers. They can be obtained from most large dealers in radio supplies. The main tuning condenser is a two-gang unit with a capacity of .00035 mfd. One section serves for the tuned radio-frequency stage, the other for the tuned detector.

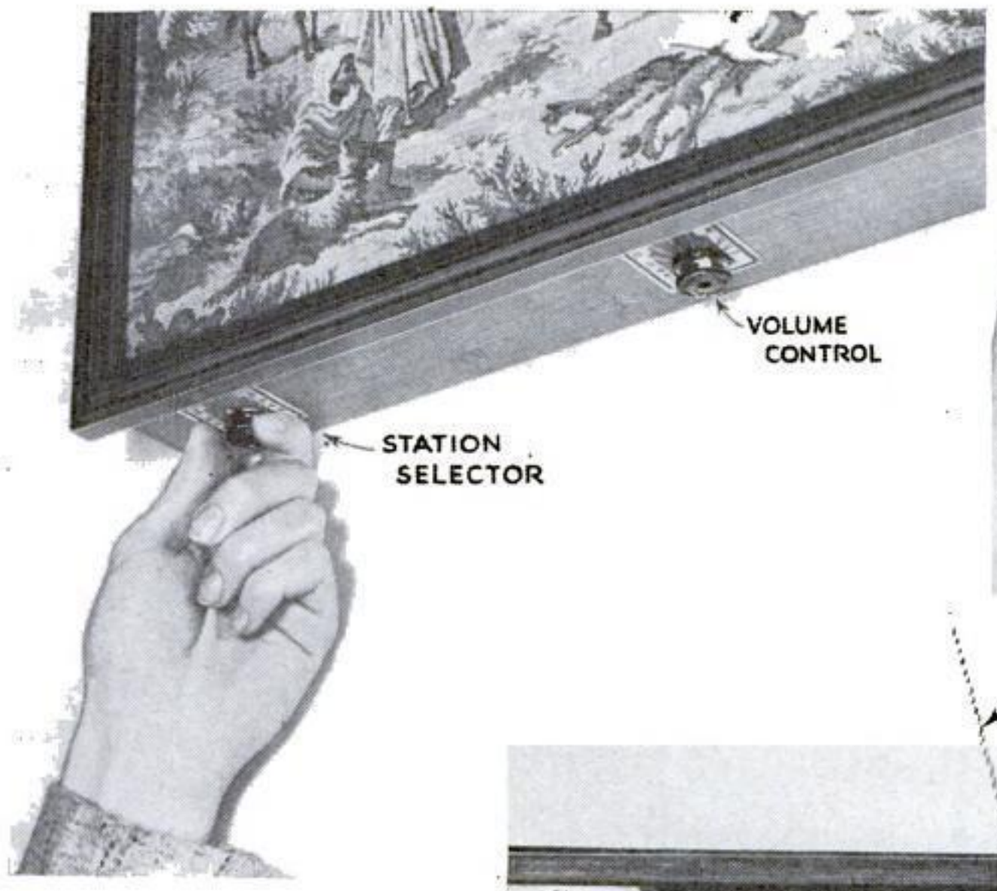
For simplicity, the number of tuning controls has been kept to a minimum. They consist simply of the condenser dial and a volume control mounted on the bottom edge of the frame so that they are concealed from view yet readily accessible. The volume control, which also contains a built-in power switch, serves to vary the grid-bias resistance of the '43 tube and should be mounted near it to keep the leads short. Short leads also are important in the grid circuits of the radio-frequency and detector tubes.

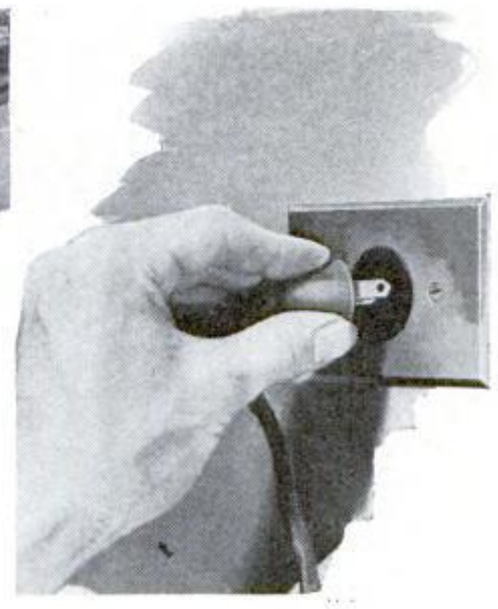
The filaments of the five tubes are wired in series with the built-in resistor. For best results and a minimum of hum, they should be connected in the exact order shown in the schematic diagram. Check your power cord as described in a previous article (P. S. M., Mar. '36, p. 56) to determine which of the three leads is the resistance. Any wrong connection at this point will send the full line voltage through the filaments and result in a blown-out tube.

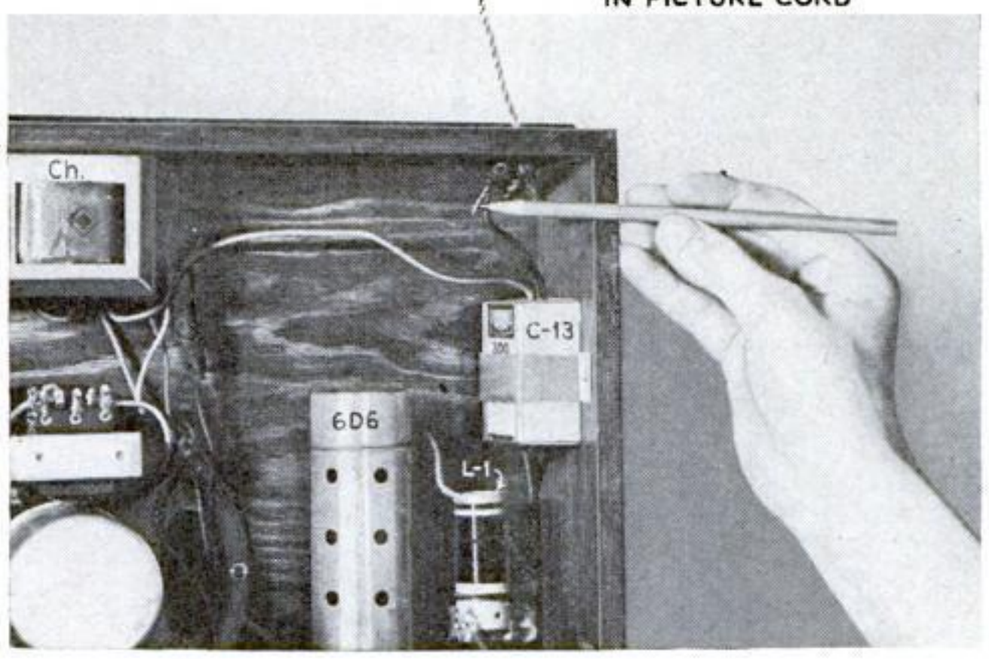
Although any type of efficient loudspeaker can be used, a new compact dynamic unit was used in the original. Operating without a bulky field coil, it takes up little space in depth and yet provides good volume and quality. Mounted in the picture frame, it is provided with a good wood baffle and, since it is aimed slightly downward by the tilt of the picture, it

By JOHN CARR

Frame Radio TO HANG ON YOUR WALL







CONTROLS AND LEADS CLEVERLY HIDDEN

The two tuning controls (condenser dial and volume control) are mounted on the bottom edge of the frame, as shown above. Upper right, a wall outlet installed directly behind the picture makes it possible to conceal the power cord. Antenna lead is connected to a wire hidden in the picture cord, as at right

LIST OF PARTS

R_1.—Fixed resistor, metallized, 300 ohm, 1 watt.
R_2.—Fixed resistor, metallized, 50,000 ohm, ½ watt.
R_3.—Fixed resistor, metallized, 30,000 ohm, ½ watt.
R_4.—Fixed resistor, metallized, 15,000 ohm, 1 watt.
R_5.—Fixed resistor, metallized, 2 megohm, ½ watt.
R_6.—Fixed resistor, metallized, 50,000 ohm, ½ watt.
R_7.—Fixed resistor, metallized, 100,000 ohm, ½ watt.
R_8.—Fixed resistor, metallized, 500,000 ohm, ½ watt.
R_9.—Fixed resistor, metallized, 2,000 ohm, 1 watt.
R_{10}.—Fixed resistor, metallized, 250,000 ohm, ½ watt.
R_{11}.—Variable resistor with switch, 500,000 ohm.
R_{12}.—Fixed resistor, metallized, 600 ohm, 1 watt.
R_{13}.—Line cord resistor (see text).
C_1.—Fixed condenser, .001 mfd.
C_2.—Variable condenser, two gang, .00035 mfd.
C_3.—Fixed condenser, .05 mfd.
C_4, C_5, C_7.—Fixed condensers, .1 mfd.
C_6.—Fixed condenser, 5 mfd.
C_8.—Fixed condenser, .5 mfd.
C_9, C_{11}.—Fixed condensers, .005 mfd.
C_{10}, C_{12}.—Electrolytic condensers, 10 mfd.
C_{13}.—Fixed condenser, .16 mfd.
C_{14}.—Fixed condenser, .001 mfd.
Ch.—Choke, 30 henry.
R. F. C.—Radio-frequency choke, 8 mh.
Misc.—Speaker, tapestry, frame, wood for cabinet, sockets, tubes, coils, wire, etc.

provides better directional effects than those afforded by a loudspeaker mounted in the ordinary vertical cabinet.

As for the frame and shallow cabinet, the amateur can make his own or have one made to order at his neighborhood picture shop for a few dollars. It consists simply of a narrow mahogany frame mounted on a rectangular box. The front of the box, which serves as the baffle and mounting for the speaker as well as the backing for the tapestry picture, is a piece of plywood cut to fit inside the rectangular cabinet and rest against the inside edge of the frame. Holes drilled in the top edge of the cabinet take the ends of the picture cord and provide an outlet for the concealed antenna lead.

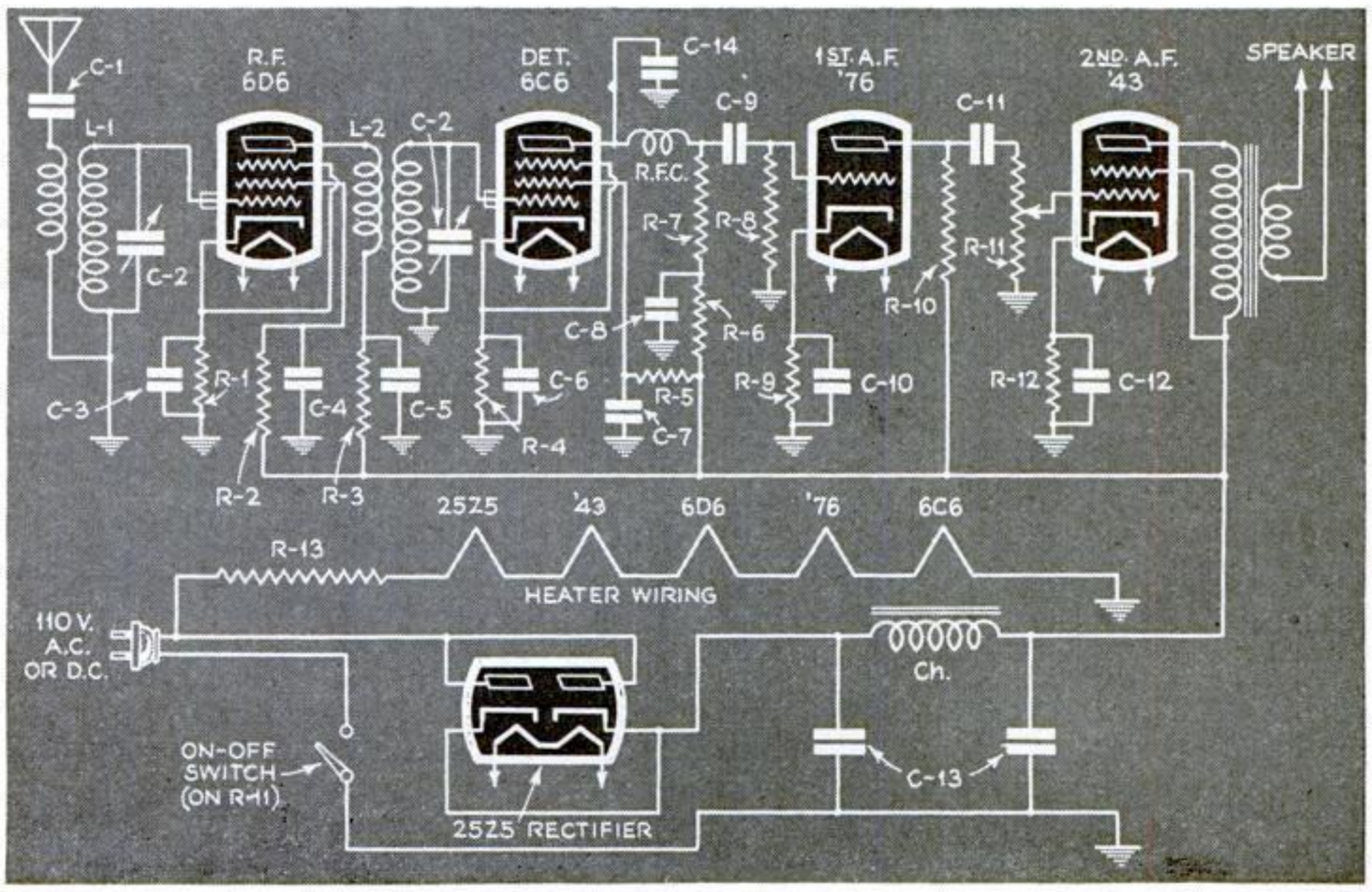
Incidentally, although a conventional V-shaped, gilt picture cord was used to hang the original receiver, two separate vertical cords could be used as well. If this is done, one cord could be used to conceal the antenna lead-in while the other could hide the insulated power-cord lead. The power cord then could be concealed in the picture molding and led to a convenient outlet. Of course, in this case a power cord with a built-in resistance would be far too bulky so that it would be necessary to install a separate voltage-dropping unit within the set.

If desired, regular silk-covered lamp cord can be used to hang the picture. The insulated wires then could serve as the power-cord lead and antenna lead. Decorative gilt tassels placed at the picture molding will cover the picture hooks and complete the disguise.

Due to the high gain of the radio-frequency and detector stages, adequate shielding is necessary. Although only a single shield placed over the tuned circuit was used in the original receiver, additional aluminum shields placed around each of the tubes (6D6 and 6C6) would improve the sensitivity by making it possible to eliminate the 30,000-ohm resistor (R_3).

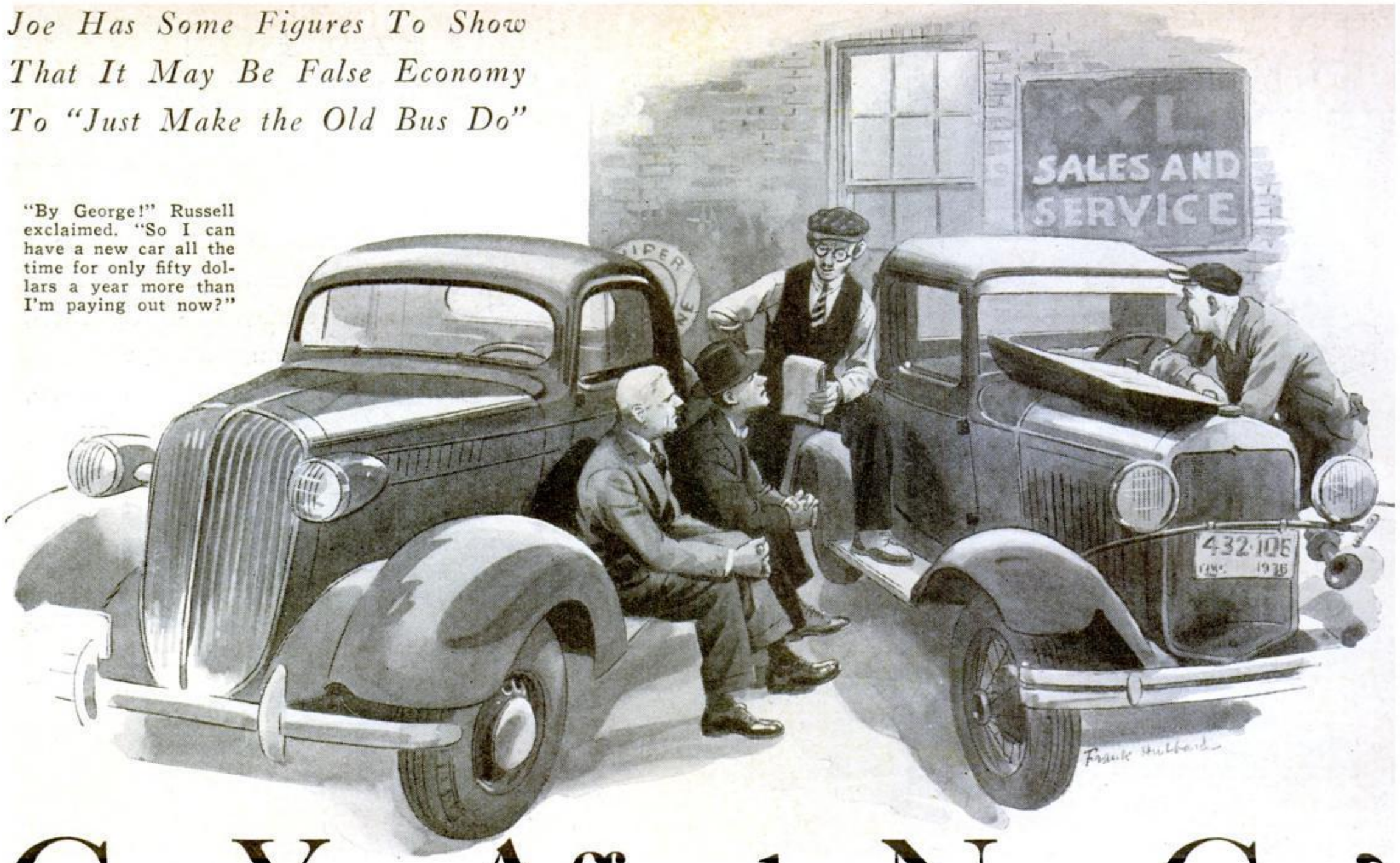
Since no external ground connection is used, one side of the power line serving as the ground, a blocking condenser (C_1) must be wired in series with the antenna lead to isolate it from the circuit. This condenser must not be omitted under any conditions.

The set tunes like any broadcast receiver, a decorative surface dial mounted under the knob control providing numbered divisions for station logging. For the sake of balance, a similar dial can be placed under the volume-control knob as shown in the illustrations.



The circuit is of the simple tuned-radio-frequency type. The spacing of parts makes wiring easy

Joe Has Some Figures To Show That It May Be False Economy To "Just Make the Old Bus Do"



"By George!" Russell exclaimed. "So I can have a new car all the time for only fifty dollars a year more than I'm paying out now?"

Can You Afford a New Car?

By MARTIN BUNN

"GOT anybody here that can fix brakes so they'll hold?" called the driver of a travel-worn coupe, as the car rolled to a squeaking stop in front of the Model Garage.

Gus Wilson, veteran auto mechanic and part owner of the business, pulled his head out from under the hood of a shiny new sedan he was tuning up.

"Pull over beside this bus, mister, and I'll take a look in just a second," he directed, as he fished a thickness gauge out of his tool kit and turned again to his job.

Jim Russell parked his old car on the spot indicated, lighted a cigarette, looked at his dash clock, got out, and fidgeted around for a minute or two.

"Any chance to get some quick action?" he fumed, as Gus continued to work on the new car. "I'm likely to lose an order if I don't get down to Jones's hardware store right away."

"Stay right here and you'll get the order," Gus smiled, "This is Jones's car and he'll be back any minute."

Gus was working on the brakes when Jones showed up a quarter of an hour later.

"That's a swell-looking boat you've bought, Larry," commented the salesman, a bit enviously, after the greetings were over. "Guess I can't expect much of an order this trip considering all the dough you've sunk in that bus!"

"Sunk is right!" Larry Jones grunted disgustedly. "When I think of all the jack it cost me just to keep peace in the family, it gives me a headache."

"That's the way I feel about it," Russell agreed. "So long as the old bus will keep running, darned if I'll fork over for a new one. Just throwing money away, seems to me. Not that I woudn't like to have a new car, though, if I could afford it."

"How do you know you can't?" Gus interrupted, as he jiggled the jack squarely under the rear-end housing. "Joe has some figures that may change your mind. Joe!" he called. "Bring out those car-expense estimates you were showing me the other day."

Joe Clark, Gus's partner in the operation of the Model Garage, stepped out of his little office with a bunch of papers in his hand and the inevitable pencil tucked behind his ear.

"Jones, here, thinks he's wasted money buying a new car," Gus explained, "and Mr.—Russell is the name?—says he can't afford one. How would you figure it, Joe?"

"That's pretty near the long and the short of it," Joe grinned, pointing first at Russell's mud-stained bus, and then at Jones's shiny new car.

"I know Jones drives about 7,000 miles a year, and I suppose you knock off 25,000 or more, Mr. Russell?"

"At least that much," Russell admitted. "Some years much more. So what's the use of putting a new car up against that kind of a job?"

"Well," Joe began, "there's a lot of ways of looking at this automobile proposition. But there's one thing certain. Every car owner wants his car to look good, give him the minimum amount of trouble, and cost as little as possible for every mile of travel."

"I guess there's no argument about that," Russell conceded with a grin.

"All right, then," Joe continued. "The whole point of this business is that the trade-in price of a car is based almost entirely on the yearly model. Mileage has very little to do with it. You have one make of low-priced car; Jones has another. If you buy a car in that class, the yearly cost for depreciation is easy to figure. It is the delivered price, less what you can get on a trade-in, divided by the number of years you have owned the car. Take one of these models that costs you, delivered, say $750. Suppose you drive it seven years. At the end of that time it would be worth about fifty dollars, so your car would have cost you $100 a year for depreciation alone.

"You'd have run up a mileage not far from 200,000," Joe went on. "You'd have worn out from ten to fifteen complete sets of tires at about thirty-six dollars a set, depending on the way you drive and handle the brakes. You'd have had to buy at least four, and maybe six, new storage batteries. The motor would have needed two to three complete overhauls, besides at least the same number of ring-renewal jobs. You'd have had the steering gear overhauled about three times, and the rear end probably at least once, not counting, say, about three universal-joint renewals, and chances are you'd have had to buy one new radiator."

"Sounds like a lot of repair work when you list it that way," Russell put in, looking ruefully at his car, "but, judging from my own experience, it seems about right."

"We mustn't forget the brakes," said Joe, "they're *(Continued on page 108)*

The completed bow bends perfectly, shoots far, and hits hard. Robin Hood himself never had so scientific a weapon. This illustration shows the bow drawn back almost to the "full draw"

Now you can shoot

THE NEW American FLAT BOW

By JACK HAZZARD

Bows are among the oldest weapons in the world, yet an amazing thing was only recently discovered about them. Through mathematical analysis, laboratory investigation, high-speed photography, and painstaking field tests, it was found that the famous English long bow, after which practically all target bows are patterned, does not have the most efficient shape. Its beautifully rounded limbs are a delight to the eye, but the best cross section for a bow is something much simpler—just a plain rectangle. This discovery led to the development of the modern American flat bow, one easily made variety of which is described here.

WHEN the white man provided the American Indian with a cheap trade musket in place of his native bow and arrow, he saved himself a good deal of grief, for had the red man developed his weapon along a logical path he might have arrived at an approximation of the bow we now know as the "semi-Indian," "flat," or "American" bow. With such a bow he could have shot with accuracy at a hundred yards (about the extreme accurate range of the long rifle), and could have delivered arrows faster than any frontier scout could load his rifle.

Any home workman, equipped with ordinary tools, can readily build the most modern and most efficient bow yet designed. The best material for the amateur is the imported wood known as "lemonwood." It can be worked almost entirely by measurement, without much regard to the grain. California yew and Osage orange probably make a better bow, but not for the inexperienced builder.

Lemonwood can be had from most dealers in archery supplies, either in the rough stave or cut to approximate outline. The price ranges from about $1.75 to $3. In ordering you should be careful to say you need a wide stave for a flat bow.

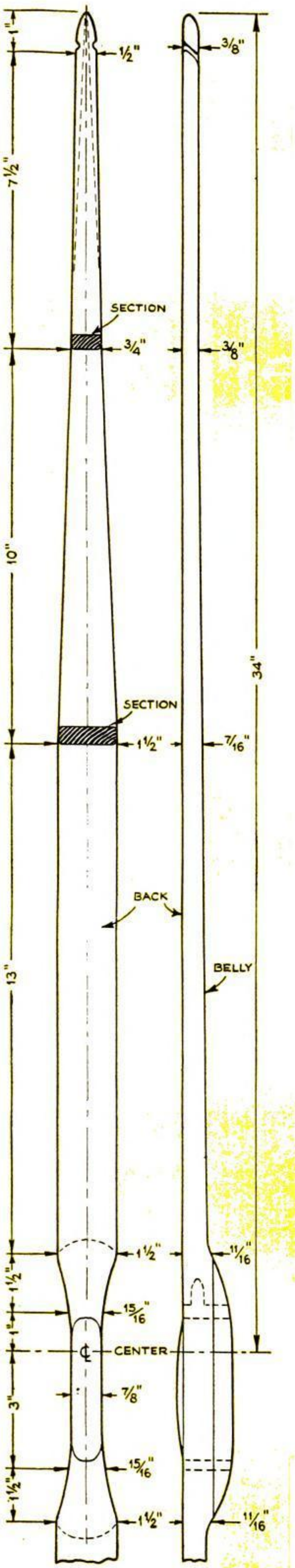
The dimensions given are for a bow 5 ft. 8 in. long with a weight (the archer's term for the strength of a bow) of from 45 to 50 lb. at a draw of from 27 to 28 in. This combination is suitable for the average man. When new the bow will draw 5 lb. or more above these figures. For clearness, only the upper limb of the bow is shown on the drawings. The lower limb is similar but slightly stronger. It should be 7/16 by 1½ in. at a point 14¼ in. below the center line; ⅜ by ¾ in. at a point 24¾ in. below the center; and ⅜ by 9/16 in. (instead of ⅜ by ½ in.) at a point 1 in. from the very end.

The stave, as it comes from the dealer, has been shellacked or varnished to prevent checking. Remove this coating from the back—the side away from the archer as the bow is held in position to shoot. Plane and sandpaper the wood just enough to provide a smooth surface. Stretch a fine piece of unkinked copper wire tightly down the center line of the stave, mark dots at regular intervals, and connect the dots, using a long T-square or other straightedge and a sharp, hard pencil.

Lay out cross lines as shown on the drawing and mark the widths by dots. Connect these dots with straight lines, giving a rough idea of the back of the bow. Since the sharp shoulders and angles are unsightly, change them free-hand to graceful curves along one side, then trace paper templates in order to reproduce the curves on the opposite side.

With drawknife, spokeshave, and finally a pocketknife or scraper and garnet paper, work to the lines marked on the back, keeping the cuts at right angles to the surface of the back.

Run straight lines along the edges of the stave from the center

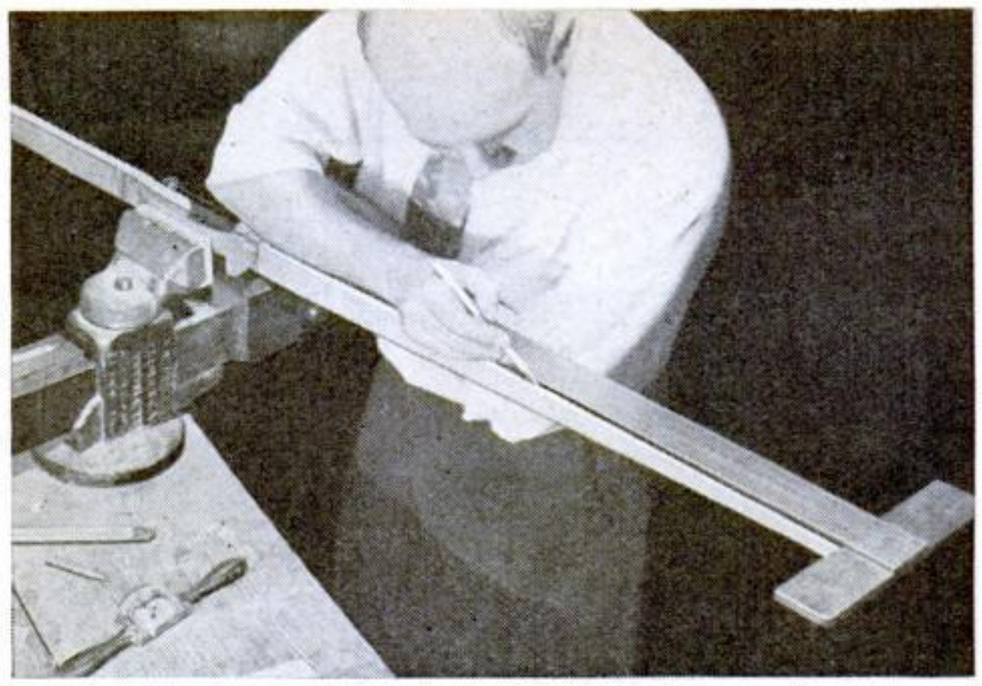


out to the tips to mark the thickness of the bow, following the dimensions on the drawing. Both edges of the stave should be marked. Now mark the profile of the riser at the grip, dipping it boldly into the run of the belly at each side of the handle. If the stave did not come with a piece glued on to form the handle, you will, of course, have to cut a suitable block of hardwood about ½ by 1 by 8 in. and glue it on.

Set the bow in the vise, belly up, and shave off the wood above the lines just drawn. For the deeper part of the cut near the tips, a drawknife may be used with caution; but nearer the handle where the cut is shallow, a spokeshave and small block plane are safer. When the bow has been worked to a rectangular cross section over its whole length, except at the riser, which is rounded, you are ready to test it for curve.

This work has probably consumed an evening, and you are obliged to lay the bow away until you have more spare time. Before you do so, rub the whole bow with shellac to prevent any possible checking or absorption of water.

You now need what is known as a "tiller" for testing the bow, as well as a temporary or working bowstring and a shooting tab for protecting the fingers. The tiller is a piece of scrap wood about ⅞ by 3 by 30 in., notched at 2- or 3-in. intervals as shown to catch the bowstring and notched at one end to fit over the handle of the bow. As the tiller may be used later on the finished handle, it is just as well to pad the end jaw with leather.



Using an old T-square to mark the lines showing the height of the belly of the bow. The vise is faced with removable wooden jaws

The tiller serves to hold the bow bent for inspection during construction and, as it will be used often, should be carefully and accurately made.

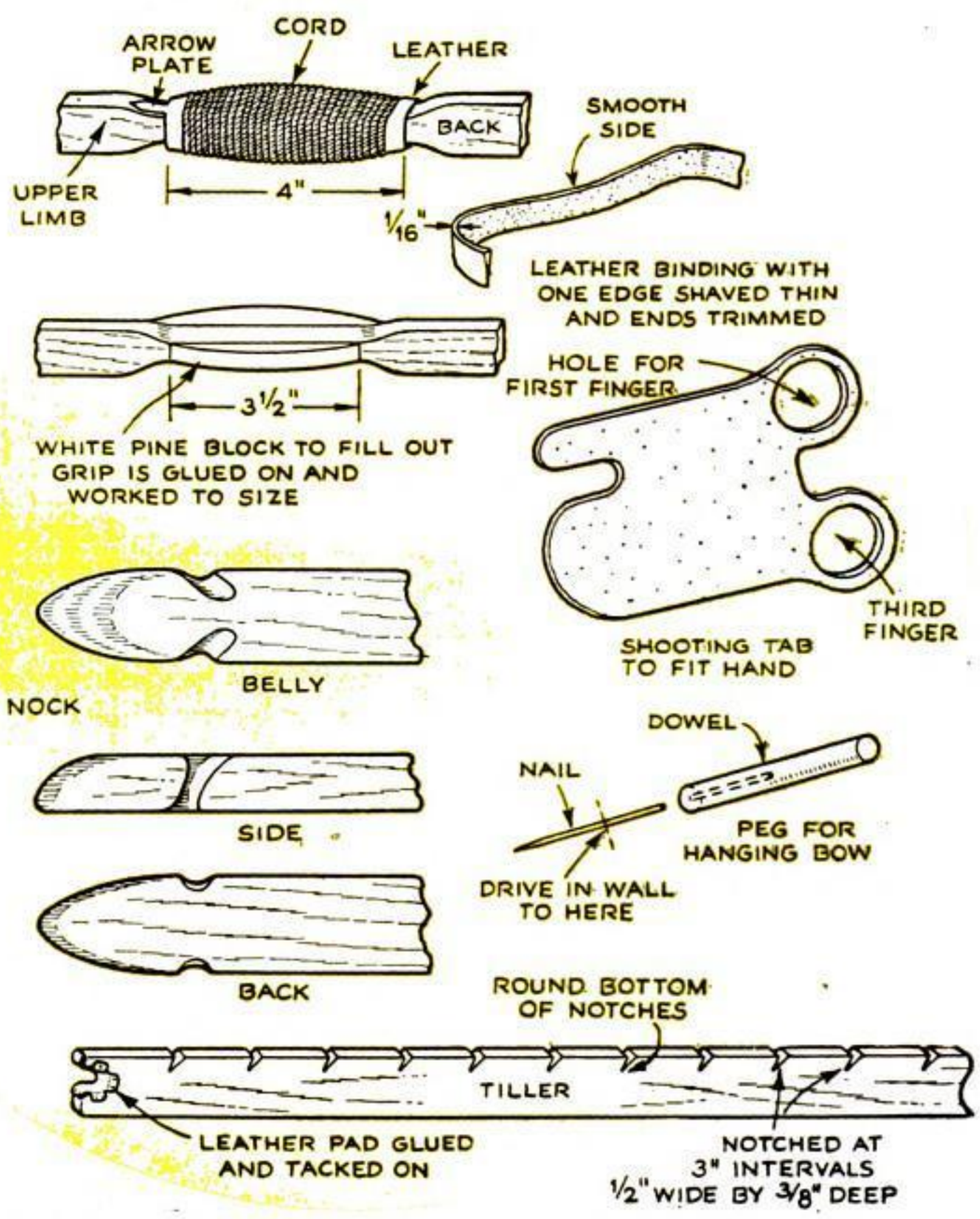
The string for tillering must be far stronger than the one ultimately used for shooting—at least 60 strands of No. 20 linen thread. Lay up twenty strands 18 in. longer than the bow, stretch them smoothly, and wax them together. Make two more sets and tie the three together. With the tied ends over a hook twist each of the three groups of thread individually to the right and have an assistant hold the twist in. Now take all three and lay them round each other to the left, as if making rope. The right-hand twist makes them grip one another and cling together. Put the string under tension and rub thoroughly with beeswax. Work it round and compact by rubbing with a small piece of leather held between the fingers. Tie a permanent loop (bowline) at one end and use a timber hitch to fasten the lower end to the bow.

Later you will need a shooting string, and because a breaking string endangers not only the bow but the archer and bystanders as well, it is better for a beginner to buy a few strings. When one of these becomes frayed, take it apart, study the make-up, read a bit on the subject, and try to make one yourself. You will soon be able to produce a creditable string.

The notches at the ends of the bow, or "nocks" as an archer calls them, are best put in with a small round file. At the side, near the back, the nocks are half round, slanting across the side toward the grip and flaring slightly to give room for the string to change direction as the bow is drawn. They should not extend across the back of the bow as this would seriously weaken the bow tip.

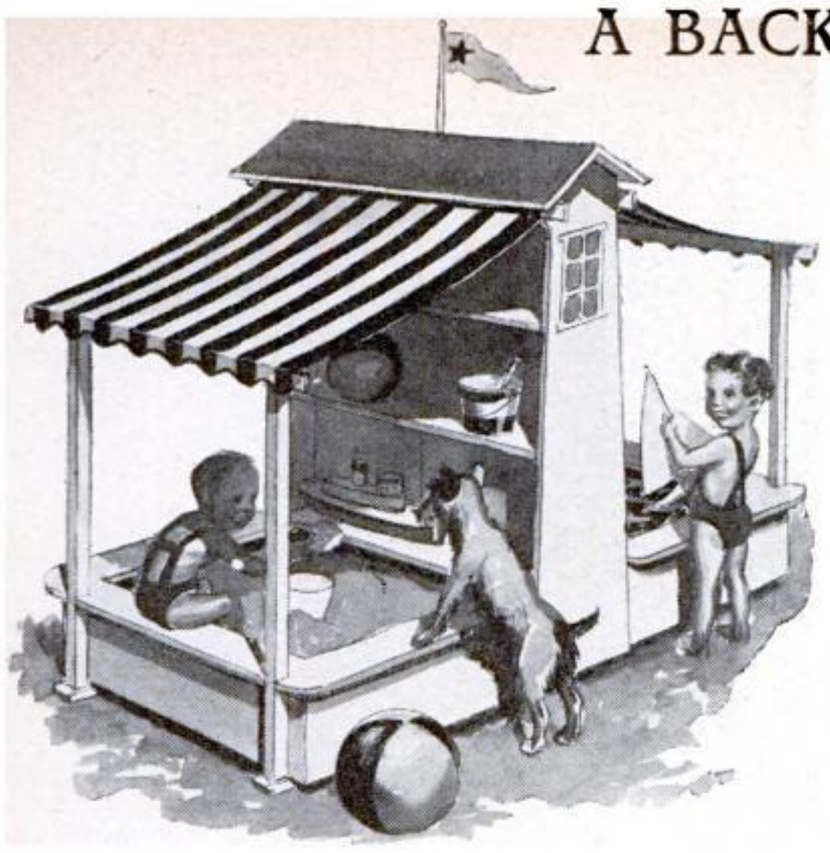
Slip the loop down over the upper tip, draw the string down the bow, and fasten it at the lower nock with a timber hitch. Have the string about 3 in. shorter than the distance from nock to nock.

(Continued on page 93)



At left are the back and side views of the upper limb and handle of the flat bow. Above are sketches showing how the handle and nocks are finished and how a shooting tab, tiller, and peg are made

A BACK-YARD "BEACH" FOR SMALL CHILDREN

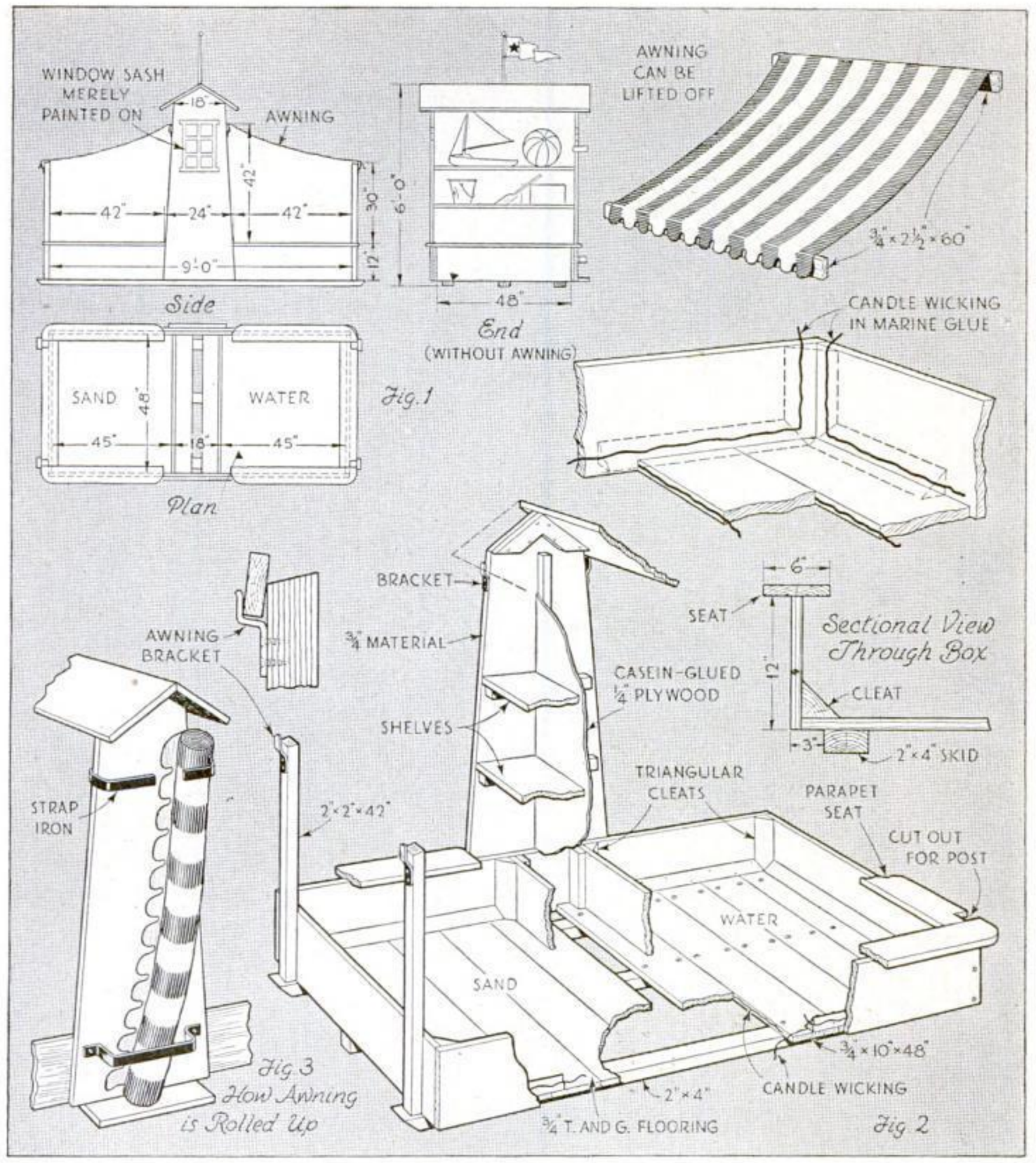


COMPACT and complete, this back-yard summer resort for small children includes a wading pool, sand-box, and shelves on which to put away boats, pails, and beach balls. Removable awnings protect against sunburn and on cloudy days are stored beside the tiny "cottage."

General dimensions are given, but the size may be increased, if desired. Skids 9 ft. 6 in. long permit moving the "beach" from one spot to another.

The sand-box floor is tongue-and-groove material. For the tank, use ¾ by 10-in. boards with squared edges. Candle wicking is laid in marine glue along each edge before the next board is drawn up tight, and it is also used at the sides and corners, where triangular cleats are nailed or screwed down over the calking. Bear in mind that marine glue is not casein glue; each has its purpose and each is excellent for that purpose. A sketch shows how the candle wicking is laid.

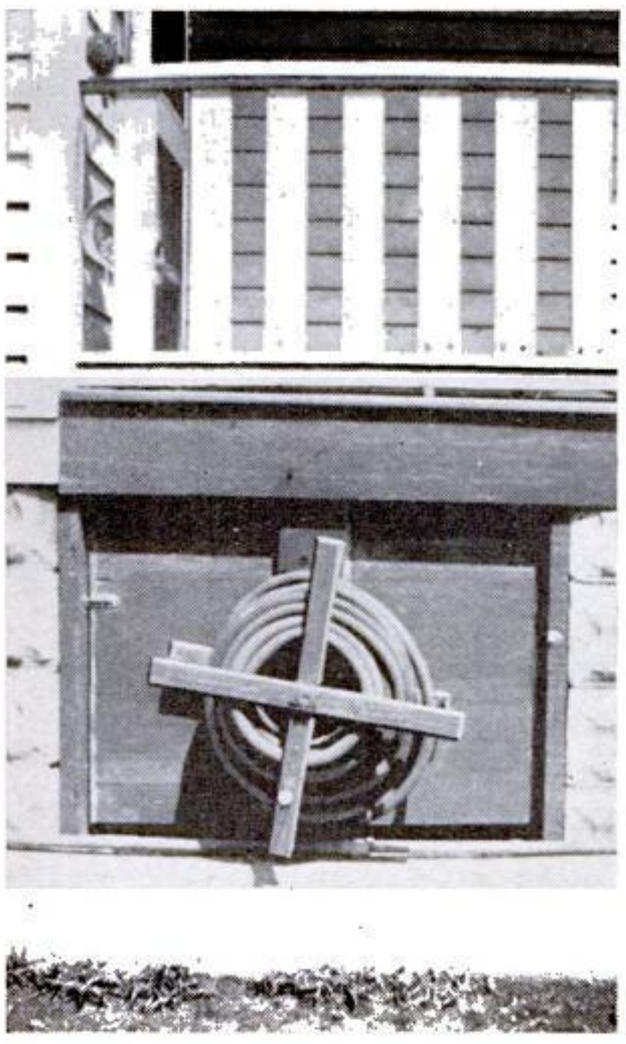
The central "cottage" is constructed as indicated in the cutaway perspective. The partition is important as it prevents water from being splashed over into the sand, and sand being tracked into the pool. Also, toys can be kept in order on the shelves.



How the combination wading pool and sand-box is constructed, and suggested dimensions

All sharp corners and edges should be rounded. The hardware should be galvanized, or very thoroughly painted. Brass screws are best for the water tank. An effective paint combination would be a dark green exterior for the sand-box and pool; a lighter green for the cottage, with a red roof; and bright yellow for the inside.

GARDEN HOSE REEL SWINGS OUT OF SIGHT BENEATH PORCH



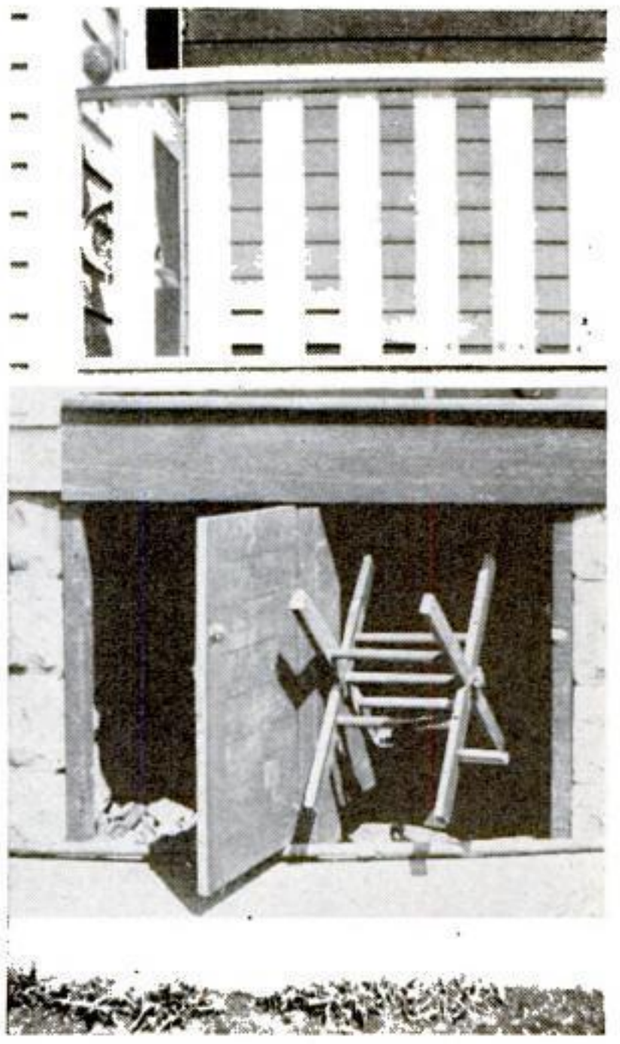
The reel swung outside, ready to be used

ONE of the most accessible places in which to store a garden hose is beneath a porch. This can often be done quite easily by mounting the reel on a revolving door, as illustrated, so that the hose is out of sight when not in use. The door takes the place of the latticework with which the space under porches of this kind is usually inclosed.

A 2 by 6-in. plank, ½ in. shorter than the height of the opening, serves as the upright on the door. Two 10-penny nails with the heads cut off are used as pivot pins. The bottom nail projects 1 in. and the top nail 1½ in. from the ends of the plank. A screw eye is used as a bearing on the inside of the facia board, while a hole about 1¼ in. deep is drilled directly below it in the sill. When the upright faces out, the door can be lifted up and out to get under the porch. Washers attached to sill and bottom of upright make the door swing easier.

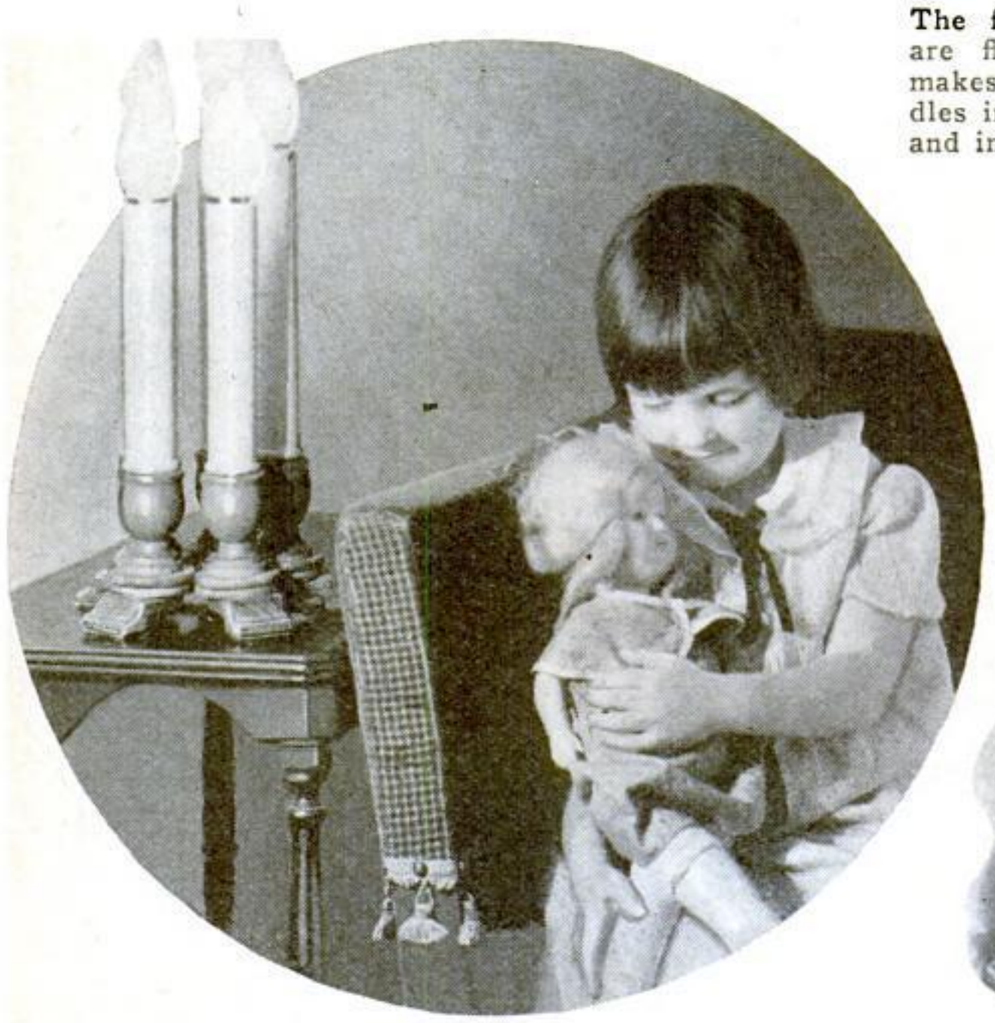
The reel can be made from four pieces ¾ by 1½ in. by 2 ft. and four rungs or broomsticks. A 1-in. pipe 15 in. long acts as the spindle. It must be threaded far enough to enable it to be locked in place with two nuts, one on each side of the 2 by 6-in. upright. The door side of the upright should be countersunk so that the nut on that side may be set in flush.

The door is fastened with a common barrel bolt on the outside and has a corresponding bolt on the inside to hold it rigid when swung out.—JOHN ROBERTSON.

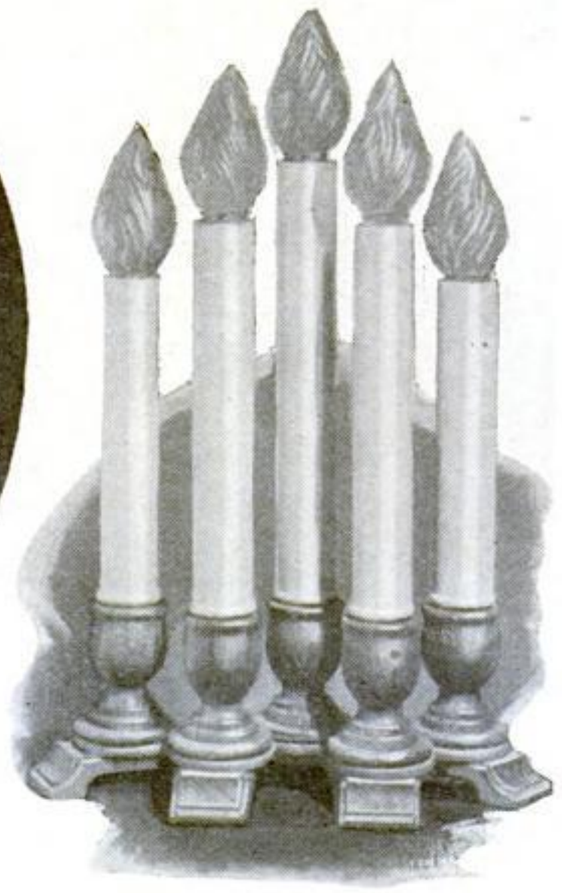


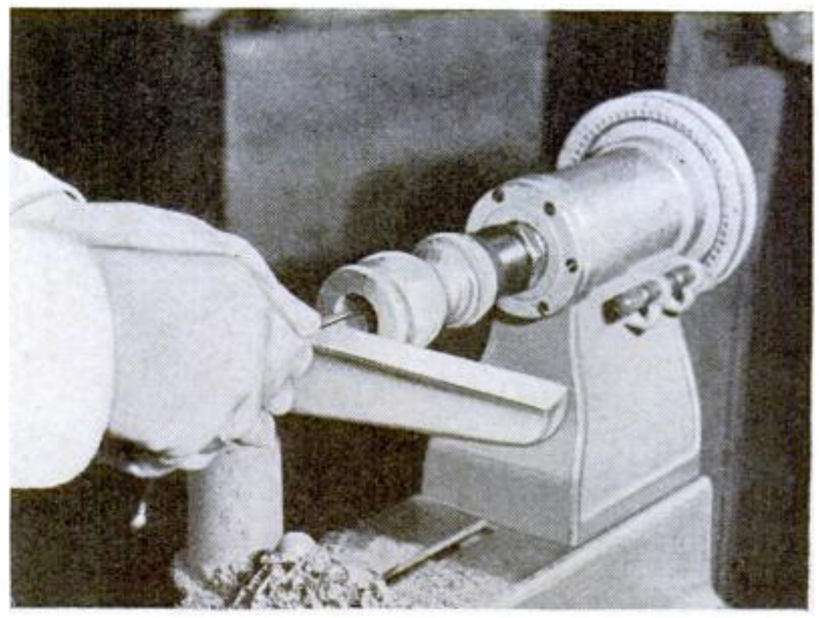
The door can be turned entirely around

Lamp of Seven Shapes *and*

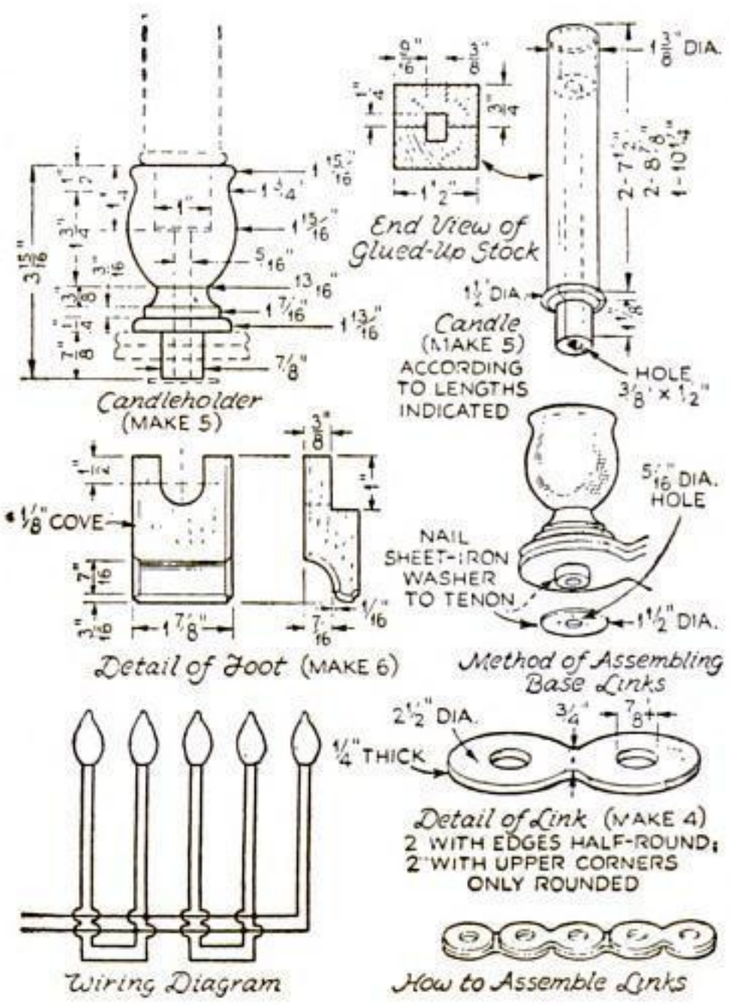


The feet of the individual candles are flexibly linked together. This makes it possible to arrange the candles in a circle as shown at the left, and in various groups like that below





The sockets for holding the wooden candles are bored by scraping in the holes from the ends with the lathe turning at high speed. Below are drawings of the candles, candleholders, and feet; details of the links and how they are assembled; and a simple way to connect the lamps



YOU will never lack a diversity of lamps if you build the candelabra pictured above. The five ivory candles with their linked holders may be arranged in seven distinct shapes to suit the available space or the mood of the moment.

The candleholders are turned from walnut or mahogany stock 2 in. square in the rough. Cut blocks 4 in. long, with square ends, and carefully center them on a screw center for turning. It is advisable to bore out the sockets before the lower tenons are reduced in size, so that there will be ample base against the center flange to prevent vibration. If you have no inside calipers, turn a 7/8-in. plug template beforehand, and bore to fit, for the candles should go in snugly. When the turning is done, bore the wiring holes.

Stock for turning the candles can be glued up from 1-in. pine or hardwood. As electric wires are to run full length, the candles must be made hollow, and this is most easily done by grooving both pieces with a dado saw. Fit short plugs in the ends when gluing together; these will serve the double purpose of aligning the grooves and providing stock for the lathe centers. After turning, bore out the plugs and hollow the upper ends to receive the sockets.

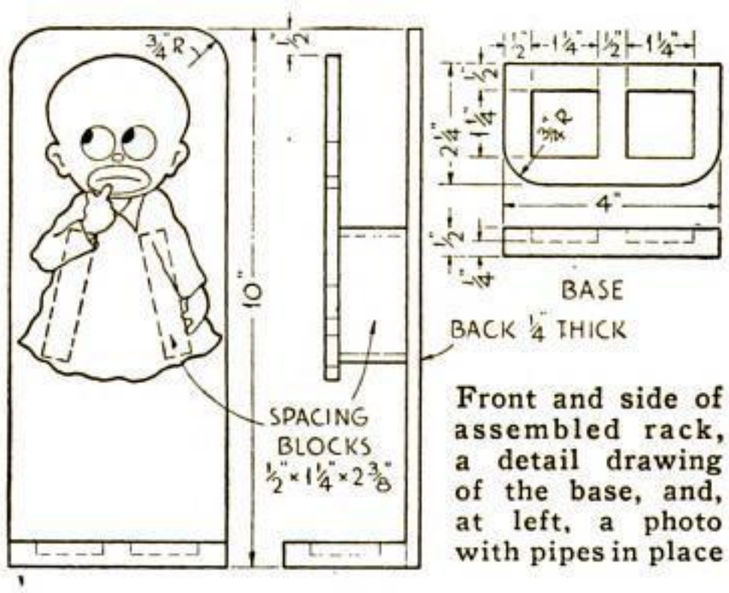
The hinging together of the candleholders is accomplished by the use of four links consisting of pairs of circles, and two independent disks. When jig-sawing the links, round back the circles on tangents as shown to form necks 3/4 in. wide. After boring for the candleholder tenons, make half-round edges on two of the links (those which are to go *(Continued on page 88)*

PICKANINNY PIPE RACK IS AMUSING NOVELTY

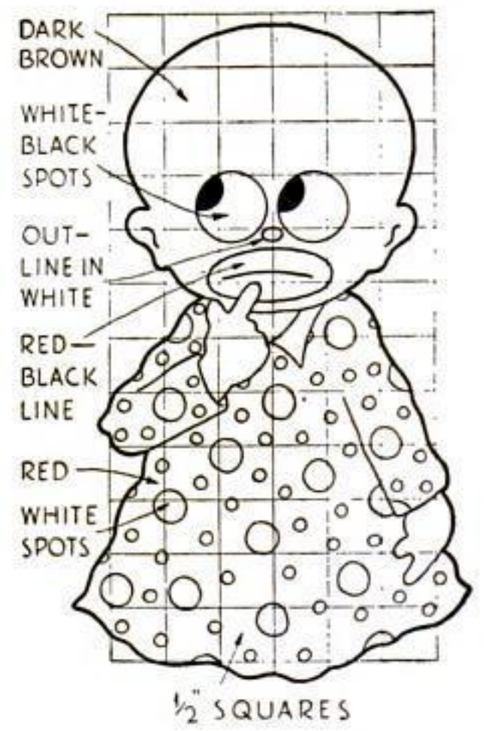
HERE'S a novelty in pipe racks. Two of your favorite briers form the legs and feet of a gayly attired, timid-faced dusky youngster. It will serve equally well as a wall or a table rack.

Only five pieces are necessary. The figure is made from 1/4-in. thick wood. Enlarge the pattern for this piece to the required size by means of the squares, transfer the design to the wood, and jig-saw to shape. Make the back also of 1/4-in. material, but use 1/2-in. thick wood for the base. Lay out the pipe recesses and rout or chisel them; then saw the piece to shape. Make two spacing blocks of the size shown. Assemble the rack with glue and brads.

Sandpaper the entire assembly, then give it a coat of flat paint or prepared enamel undercoater, after which the desired colors may be applied. The back and base of the original were finished in pale green, and the figure colored as noted. A picture hanger should be tacked at the top of the back piece if the rack is to hang on the wall; otherwise glue felt under the base.—CARL SORENSEN.



Front and side of assembled rack, a detail drawing of the base, and, at left, a photo with pipes in place



NOVELTIES ALWAYS IN DEMAND

You'll find your friends appreciate novelties like this pipe rack, and making them is a pleasant relief from more serious home workshop tasks. Besides, the cost is trifling

Other Woodworking Projects

Novelty is Keynote in This Month's Selection, Which Includes a Unique Refreshment Tray With a Whittled Wooden Cactus in the Center for Holding Titbits

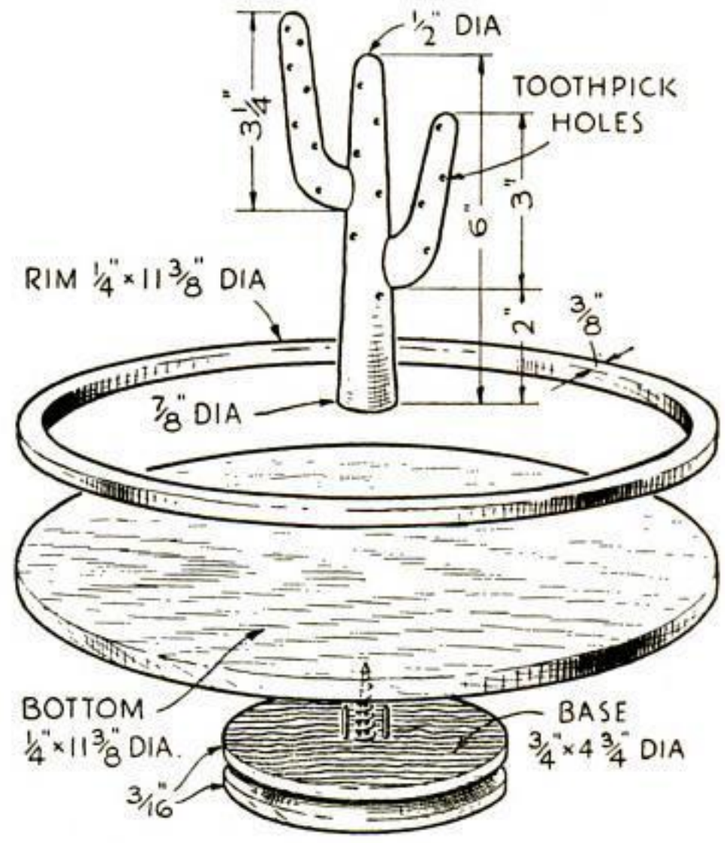
LIGHT refreshments at bridge or tea are attractively served on this tray. In the center is a cactus plant carved from wood, which holds brightly colored toothpick skewers for dainty titbits. Ample room is found on the tray itself for sandwiches and beverages.

All stock but that for the cactus is of maple: base, solid; rim and bottom, plywood. Suppose we start with the jig-sawed parts. The bottom and rim are both the same diameter, 11⅜ in., and the rim is ⅜ in. wide. Glue the rim to the bottom and when the glue has set, sand the circumference to a uniform smoothness.

Easily carved pine is used for the cactus, which is made in three pieces, the stock being ⅞ in. thick. Jig-saw these parts; then cut and sand them to the shapes shown in the drawing. Give the arms of the cactus good fastening areas on the trunk, and use brads and glue. Drill the toothpick holes at angles to give a prickly appearance. Also, it is well to drill a hole in the base of the trunk so that when it is screwed to the tray, it will not split.

The last piece, the base, is jig-sawed from ¾-in. stock, fastened to the faceplate, and turned to the design shown. Sanding is most readily done while the base is in the lathe. A hole should be drilled and countersunk in the center of the base to receive a long wood screw. Fasten the plywood bottom to the base with three brads, driven where they will be covered later by the trunk of the cactus.

Stain the cactus green and give the rest of the assembly two coats of clear varnish, sandpapering lightly between coats. The tray is completed by securing the cactus with glue and a 2-in. screw.—D. W. PRINCE.



The four parts of the tray, with dimensions

BLUE MIRROR SERVES AS BACK FOR ANTIQUE BOOKSHELF

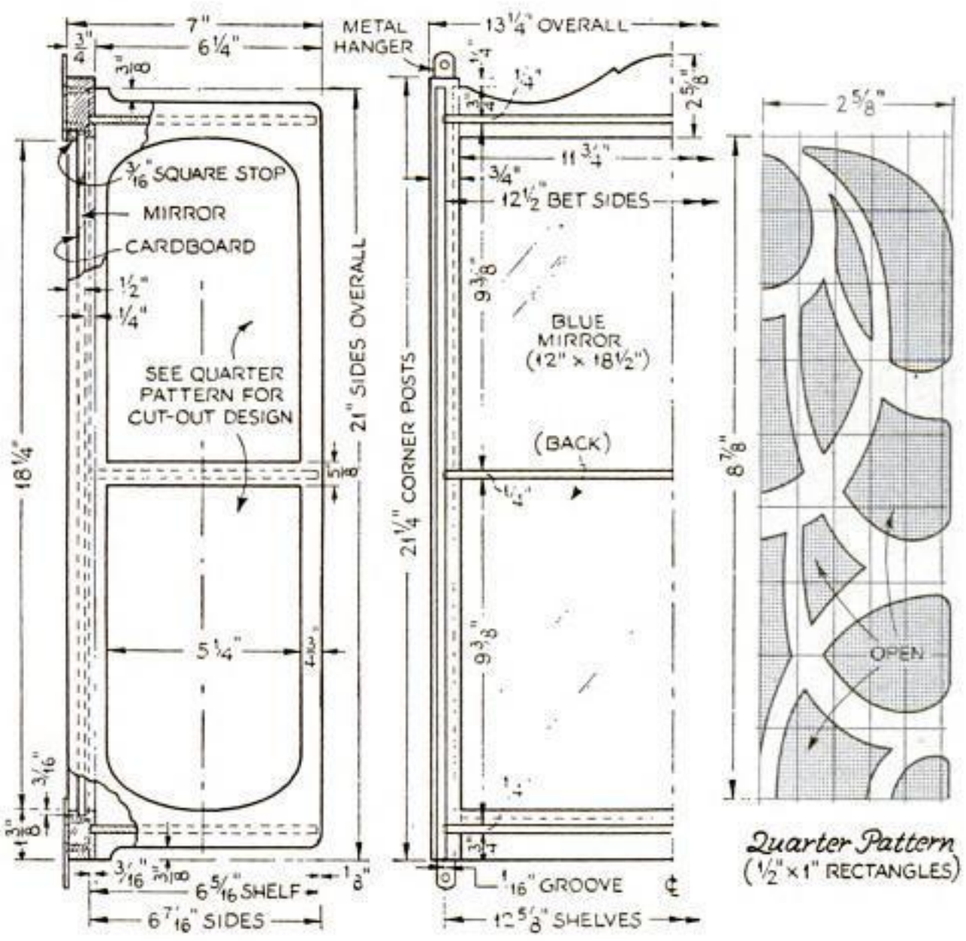
A DISTINCTIVE setting for a favorite bit of bric-a-brac is the eighteenth century hanging bookshelf illustrated. It is made doubly charming by its mirror back. If, in addition, the mirror is of dark blue plate glass, a particularly rich effect is obtained. Your glass supply house can usually obtain this with little trouble at a reasonable price. The blue mirror used in the model illustrated cost $2 compared with $1.35 quoted for a clear glass mirror.

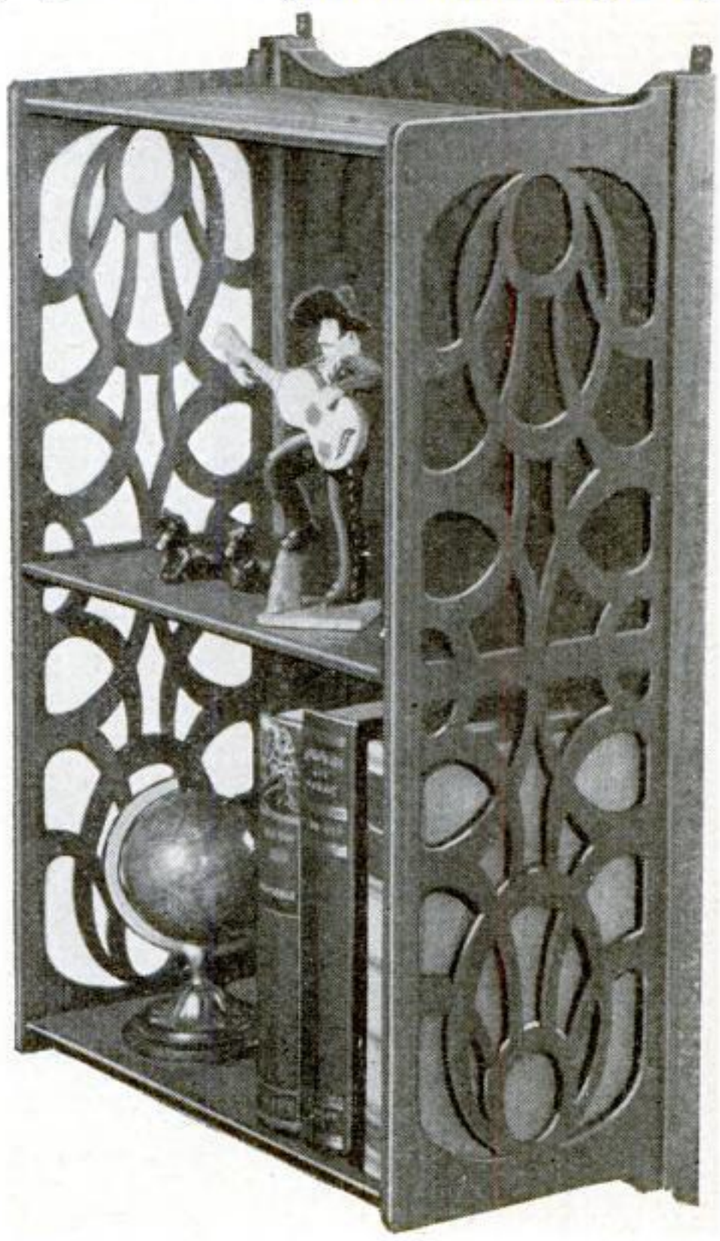
The design consists essentially of a mirror frame grooved to take the ¼-in. wood of which the sides and shelves are made. Glue joints are used throughout. If you do not care to put too much dependence upon your glue joints, ¾-in. brads may be used to reënforce them.

It is suggested that the mirror frame, consisting of the corner posts and head- and tailpieces, be machined and glued up as the first step. A study of the corner-joint sketch on page 89 will aid in clarifying the grooving of these members, which may be done on the saw or vertical spindle shaper or with a routing cutter on the drill press.

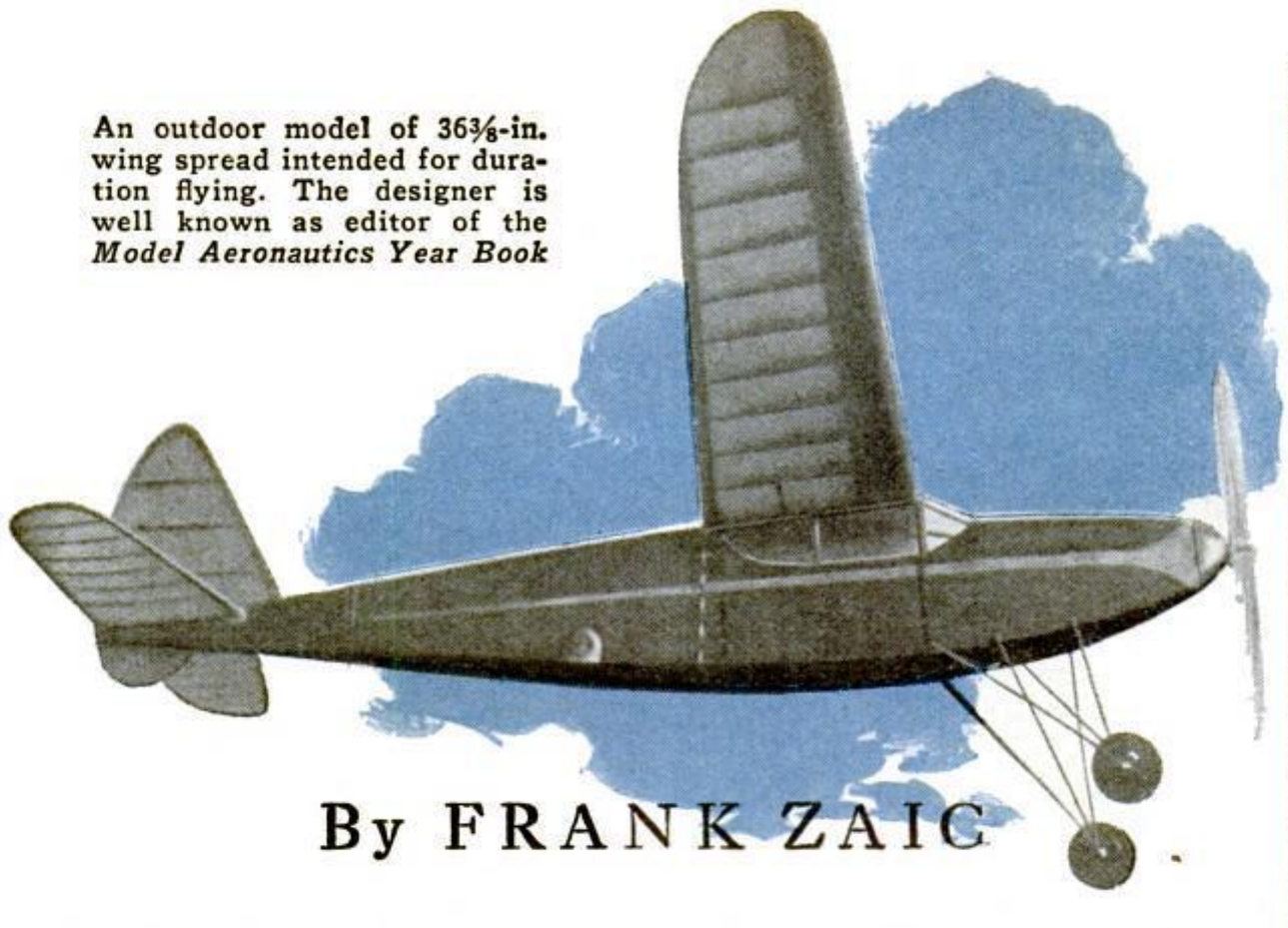
After the frame is dressed and sanded, the sides and shelves may be fitted to it and to each other. The sides should be squared to the over-all size of 6 7/16 by 21 in., but leave the trimming of their ends to contour till after the scrollwork is done. They are grooved 1/16 in. deep to take the shelves. The location of these grooves should be carefully checked with the spacing of the grooves in the head- and tailpieces, which take the rear edge of the shelves.

Now draw a quarter pattern only of the scrollwork on thin paper. Apply this in the proper location *(Continued on page 88)*





Hanging shelves for books and bric-a-brac. The back is a dark blue plate-glass mirror. Complete working drawings are given at left



An outdoor model of 36⅜-in. wing spread intended for duration flying. The designer is well known as editor of the *Model Aeronautics Year Book*

NEW *Thermal Hunter* PLANE MODEL *Built to Break Records*

By FRANK ZAIC

HERE is a model airplane that may break the existing world records for flight this summer. By utilizing the rising air currents, this so-called "thermal hunter" quickly attains considerable height, and its gliding range is much longer than the average miniature craft.

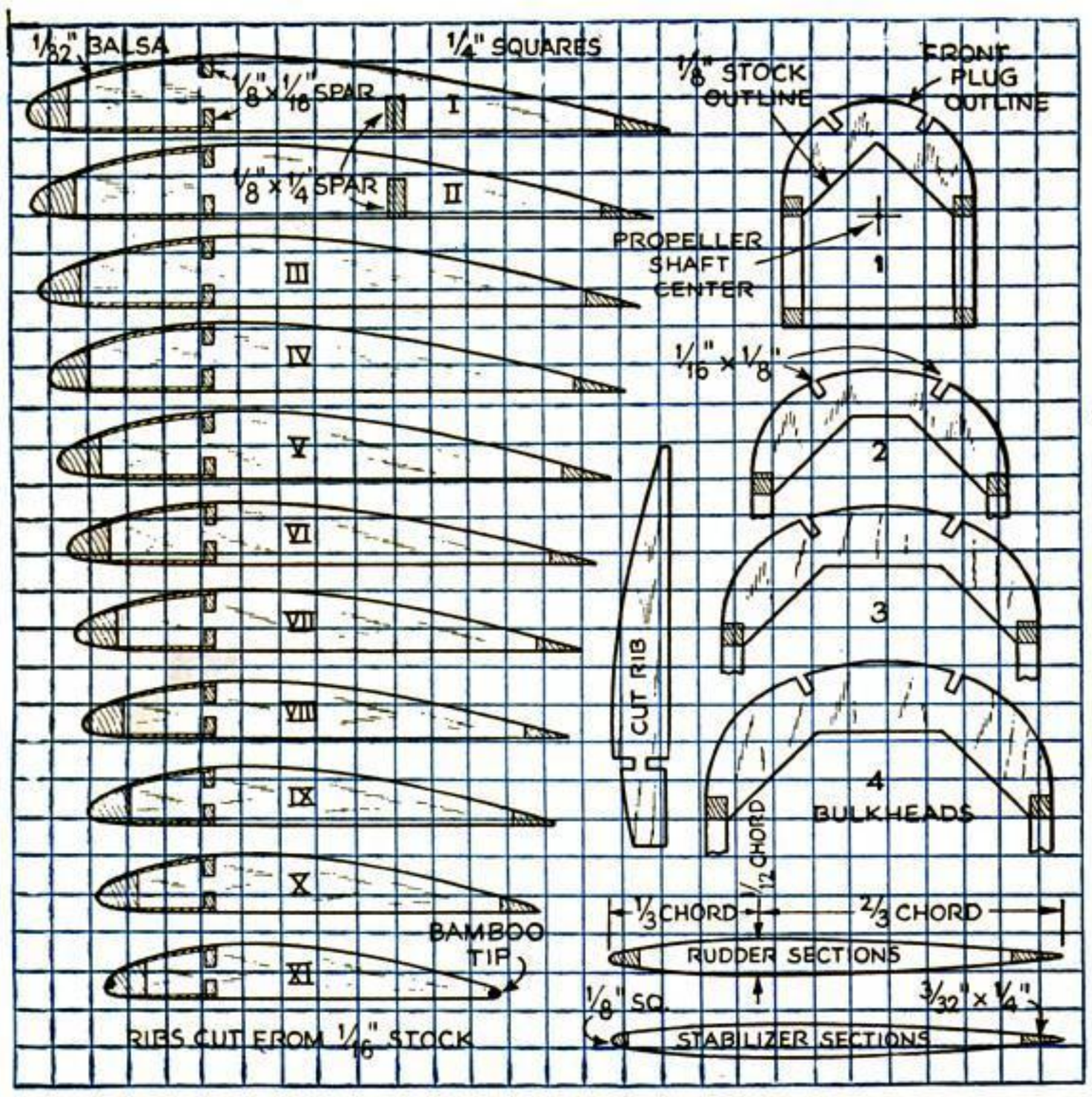
With most of the present outdoor records well over the half-hour mark, model airplane builders are faced with the problem of how to establish new records. The propeller run of an average model is between one and two minutes, and the problem is how to get the needed extra thirty to forty minutes. The qualities needed are lightness, streamlining, a high climb, and a good glide. Lightness and strength is had by using sheet-balsa in the form of box construction. Streamlining is just a matter of having a good shape with round corners, sanding and polishing all moving elements, and lining up the thrust line with the wing and tail incidences. High climb depends on the amount of rubber used. The glide depends on the adjustments made on the model while testing.

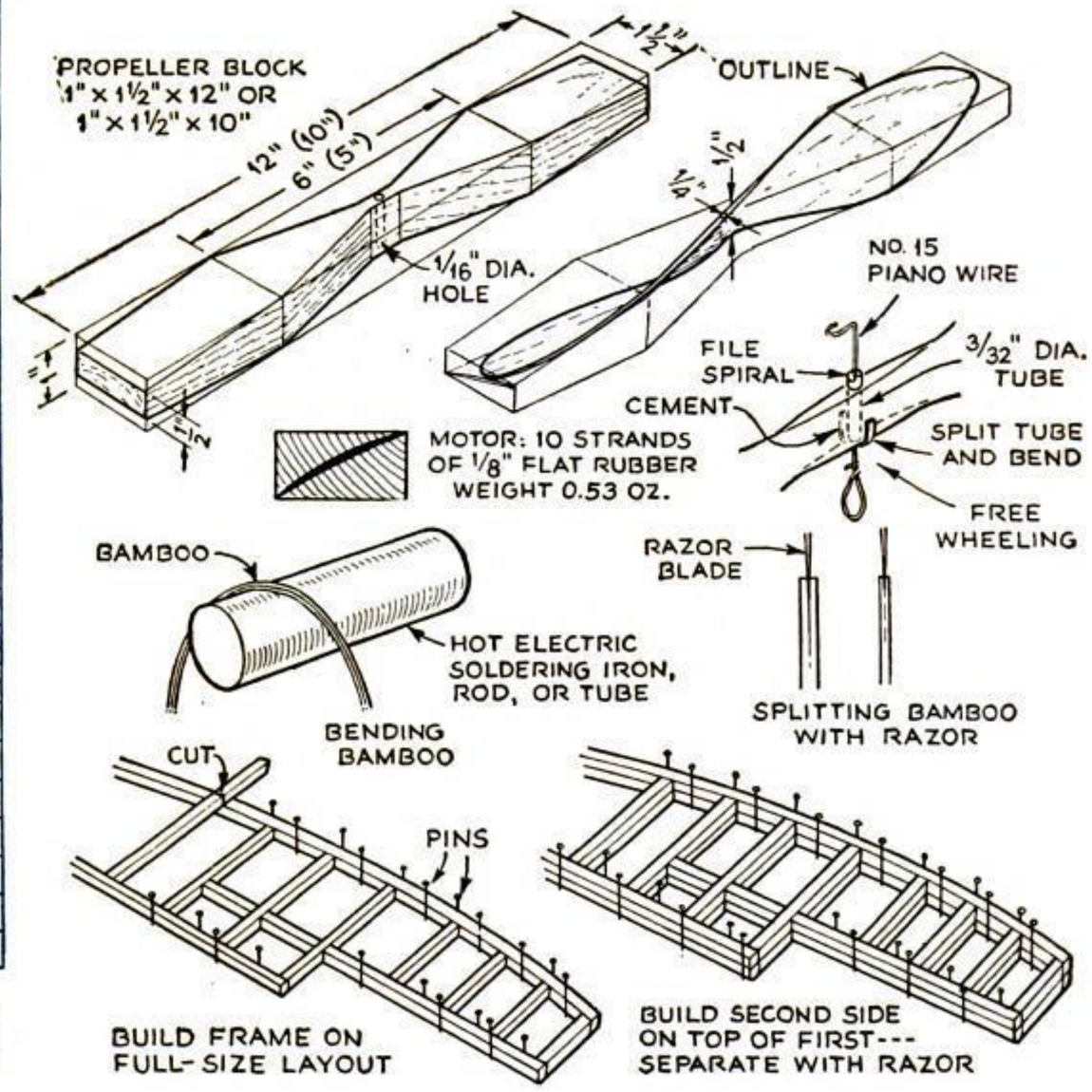
Draw the fuselage outline and uprights on white paper, tacked to a soft board, and wax all points at which the cement is likely to touch it. Stick pins on this outline wherever the uprights meet the longerons, and where the curves are severe. Hold the longerons in place against the pins with other pins. Fit the uprights with emphasis on the proper angle. Make two uprights at a time and set one aside for use on the opposite side. After one side is finished and recemented, the other side can be built right on top of it.

The two sides are assembled by cementing the center cross braces first. Line up the sides and hold them in position with square blocks. The remaining braces are cemented from the center out. The braces should be cut to size before assembling. Note the extra large braces at the front and at the rear-plug point. Also note the curve as well as the incidence of the stringers on which the stabilizer rests. Let the fuselage stay in the jig until the cement is dry.

The landing gear is made of wire because it cannot be broken. The tripod system is used so that no soldering is required. Bend the wire to the shapes indicated. The axle portion is of X-form with the upper portion closed. The four struts are made from one piece of wire so shaped as to form two V's connected by a flat upper portion, which is fixed to the fuselage. Note how the connecting loops are made. Place the shaped wire in the fuselage without fixing it until the loops are connected. After the loops are intertwined, the wire is bound and cemented to the cross braces and longerons.

The wheels are made as shown from





Patterns for the ribs, bulkheads, and rudder and stabilizer sections, all laid out on ¼-in. squares; and, at right, the propeller and construction of frame

STREAMLINED OUTDOOR DURATION FLYER CLIMBS ON ITS OWN POWER AND GLIDES A LONG WAY ON RISING AIR CURRENTS

hard balsa. The axle bushing is a piece of tubing with an end split to allow for curving the two sections into the wood. The tube should extend beyond the wheel to coöperate with the axle back hook.

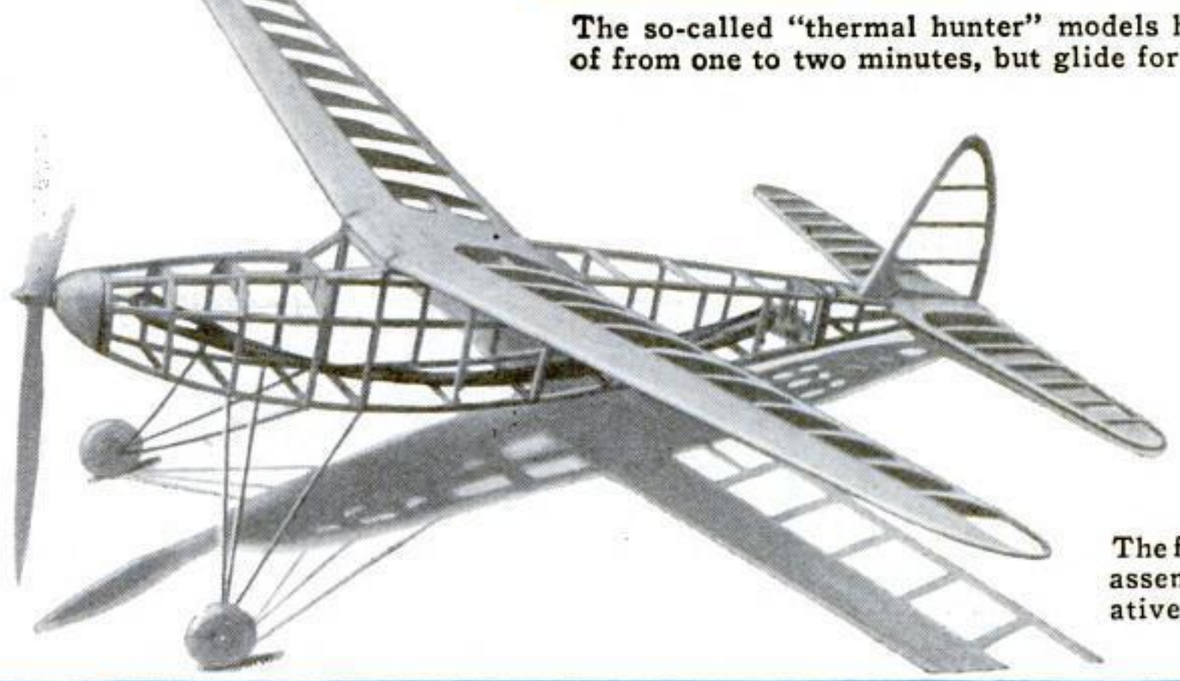
The bulkheads are cut to sizes from 1/8-in. hard balsa. Cement them in place and fix the stringers into the slots. The front portion of the fuselage is covered with 1/32-in. sheet balsa to provide the needed handling strength. Start the covering on the upper curve first and trim the sheet to the halfway thickness of the stringers. The subsequent sheets must be fitted to this cut. If the balsa cannot be bent to shape for full length, the stations difficult to handle may be covered individually.

The front plug is carved to shape from hard balsa. The sizes are determined by the opening of the first bulkhead for the 1/8-in. stock, and the outline by the balsa covering. The plug should fit snugly to provide frictional contact for holding it in while the model is gliding. Be sure to have the required down thrust by holding the plug at an angle while drilling the shaft hole.

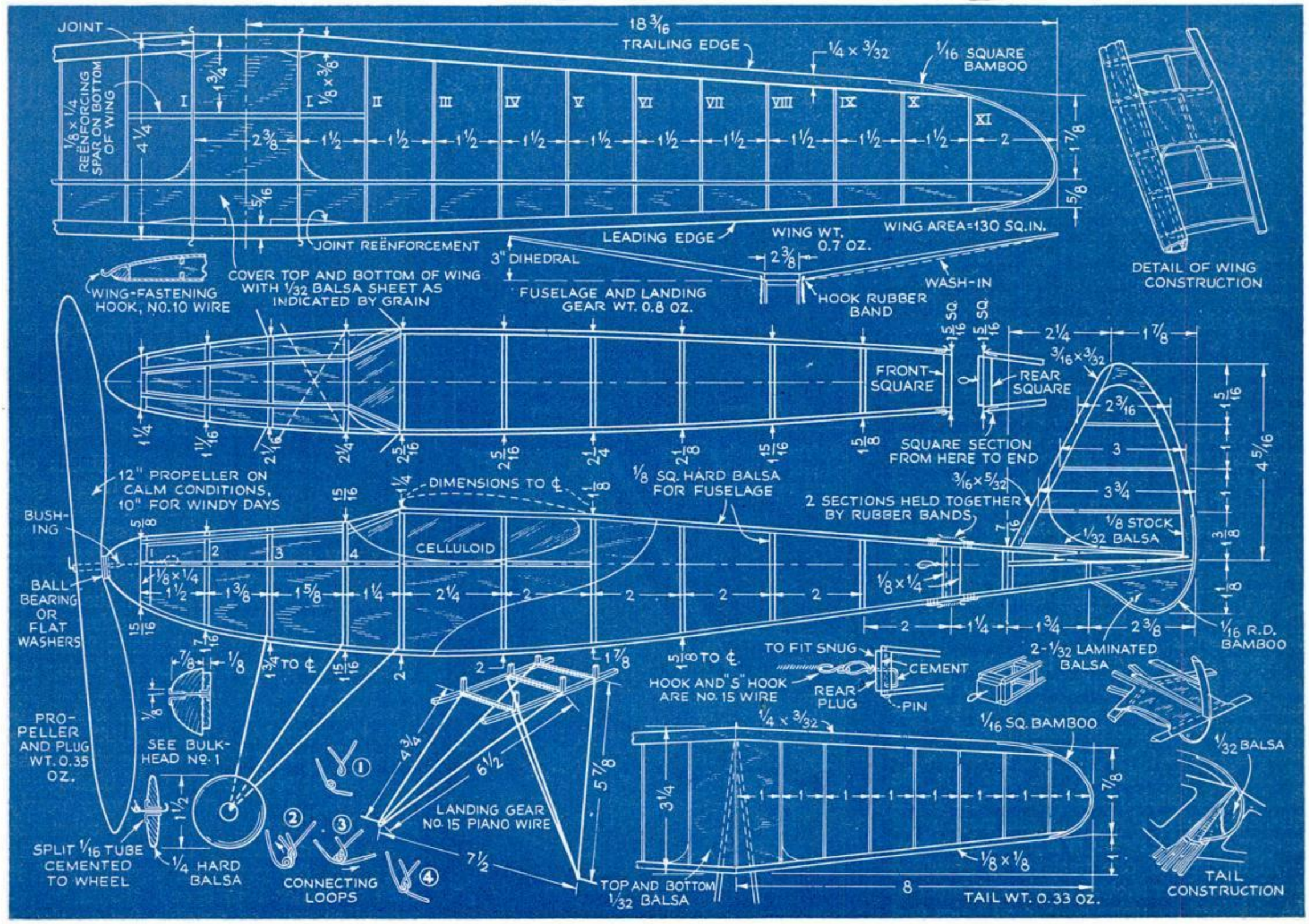
Carve two propellers, one 10 and the other 12 in. The smaller size is used for testing and gusty weather, while the larger size is for calm days. Sand to shape with rough sandpaper and finish with No. 10/0. The blades should be doped with two coats of cement, sanded, and polished. They may also be covered with silk for strengthening. The "free wheeling" is made from a metal tube by cutting a spiral on one end and splitting the other end

(Continued on page 92)

The so-called "thermal hunter" models have a propeller run of from one to two minutes, but glide for many minutes more

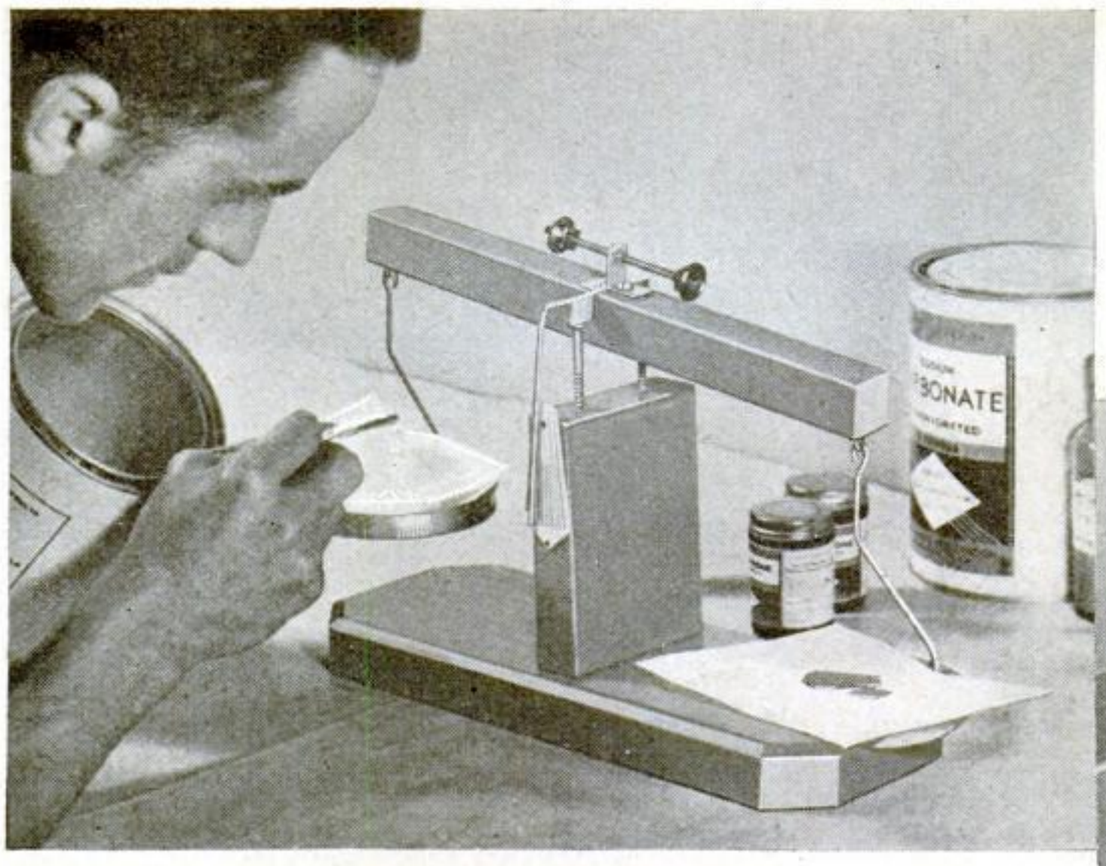


The framework of the model assembled to show the relative position of the parts

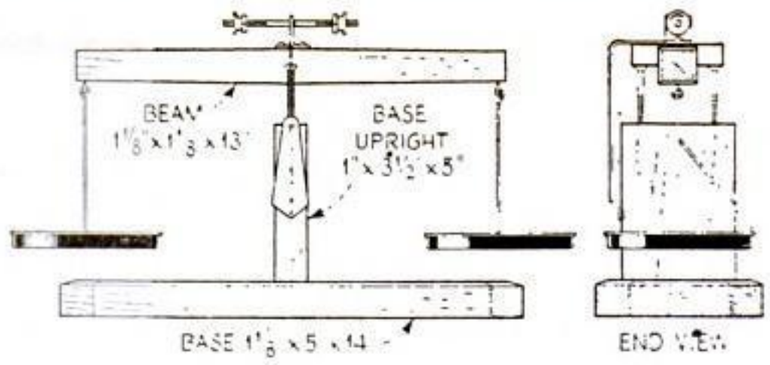


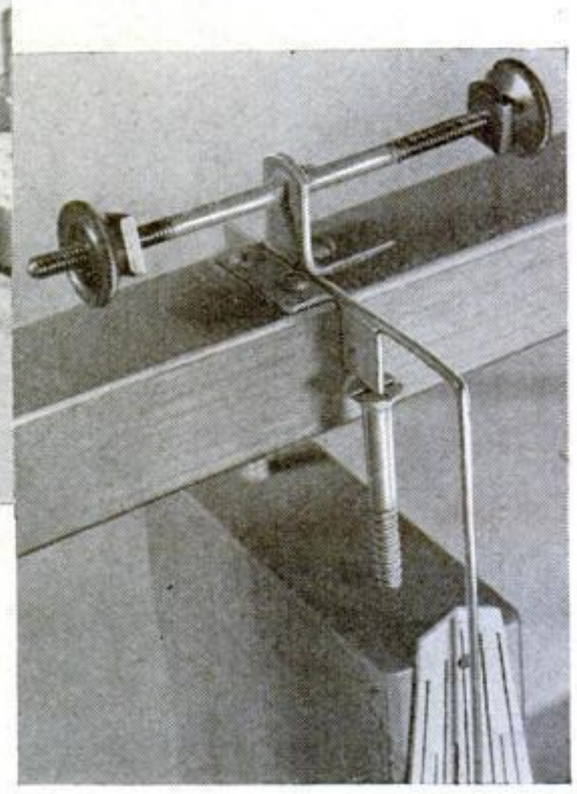
Working drawings of the wing, fuselage, tail, landing gear; diagram showing the dihedral and "wash-in"; and a variety of construction sketches

SCALES FOR WEIGHING CHEMICALS BUILT AT TRIFLING COST



The scales are shown in use at left, and the dimensions are given at right. The weights are cut from sheet aluminum, lead, and copper, and carefully matched with a set borrowed from a druggist or chemist





A brass fulcrum bar is let into the beam, as at the right, and filed and stoned to form chisel-edged bearings

CONSTRUCTED mainly from left-over scraps of material at a cost of not more than twenty-five cents, the scales illustrated are sensitive to within a grain and therefore amply accurate for photographic work and all but the more exacting chemical experiments usually undertaken by amateurs.

The base and upright are made from pine, cut to the dimensions given in the drawing. The two beam supports are 3-in. wood screws turned partially into the top of the base upright. Do not, however, use the regular screw slots to rest the fulcrum edges of the beam in, but make nicks with a three-cornered file at right angles to the slots. Slip stone these new nicks smooth.

The beam is made of pine and slightly tapered from the middle to the ends. The fulcrum bar, which is let into the beam, is made from a small piece of sheet brass; and the two lower edges, protruding on either side of the beam, are filed and stoned to a cold-chisel type of edge.

The device for adjusting the balance is formed from a 4-in. length of ⅛-in. rod, threaded 1½ in. at each end. This is then soldered at its middle point to the small supporting angle through which is passes. In the absence of a suitable tap and die, simply solder two flatheaded bolts by their heads on each side of the angle bracket. This angle is fastened with two small wood screws on top of the beam. The threaded rod is provided with a nut and lock nut at either end.

The trays were formerly the lids of ½-lb. tobacco cans, 4½ in. in diameter. The small hooks under the beam for suspending the trays were formed by cutting away a section of two small screw eyes. Before painting the scale, cover the suspension hooks and all other bearing points in order to avoid the additional friction that paint would cause. The indicator is merely another scrap of wire, and the dial a piece of suitably marked Bristol board.

Should the scale be used in a position that is not level, a leveling device must be added.—R. O. L.

GARDEN-CHAIR FRAME MADE OF PIPE

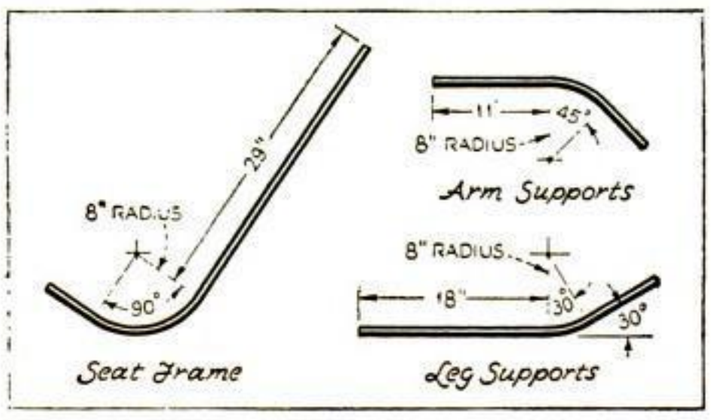
A COMFORTABLE garden chair may be constructed at home from ordinary water pipe, a few fittings, and a gayly colored piece of awning. The method of assembling is shown in the photograph.

Rummage any junk yard for a quantity of ½-in. pipe or electrical conduit and buy six ells, eight tees, and four pipe caps. Borrow a pair of pipe wrenches and a pipe-threading die, stock, pipe cutter, and vise from a local plumber, or, if necessary, pay him to do the cutting and threading.

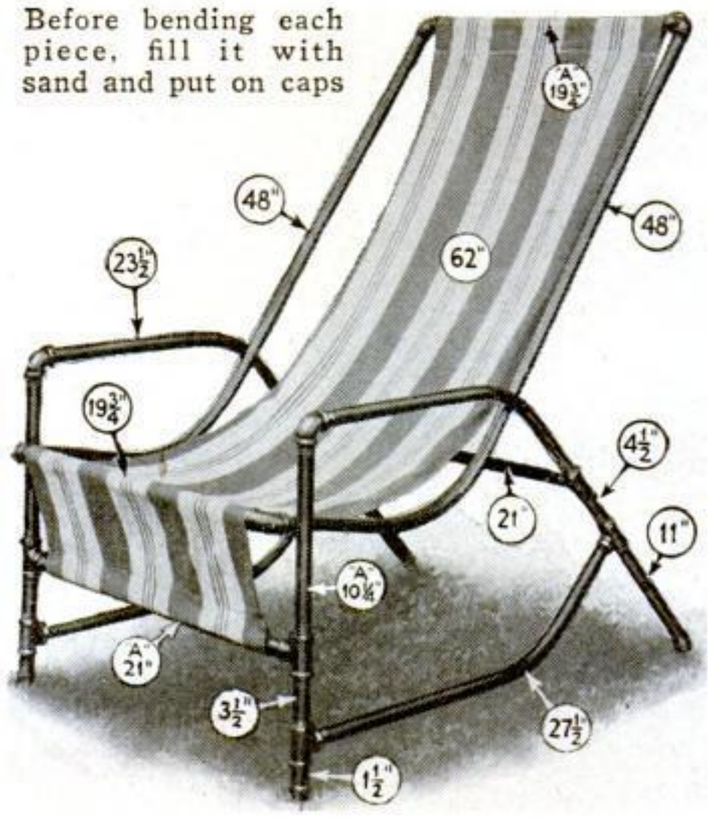
The sections of pipe marked *A* must be threaded farther than usual at one end so that it will be possible to screw that end in deeply, then back it partially out as the other end is screwed into place. This is necessary because the connections can be obtained only with the standard right-hand thread.

After the chair has been assembled, select a good steel punch and punch lock each end of the pipe securely into the connection to prevent possible turning. The awning length given (62 in.) does not include the amount lapped over for the hems. The chair photographed has green striped awning cloth with pin striping of orange, and the metal is lacquered orange.

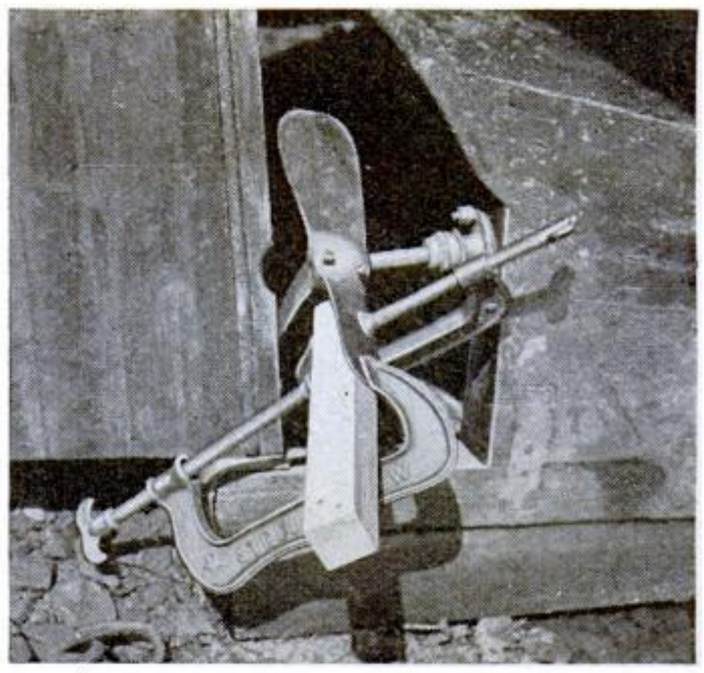
Although but one position is provided for in the chair shown, other positions can be obtained by using additional holes and a slip pin.—H. DEERWESTER.



Before bending each piece, fill it with sand and put on caps



A colorful and durable chair for the lawn



The bent blade is drawn back into shape by using a block of wood and two large clamps

STRAIGHTENING A BENT MOTOR-BOAT PROPELLER

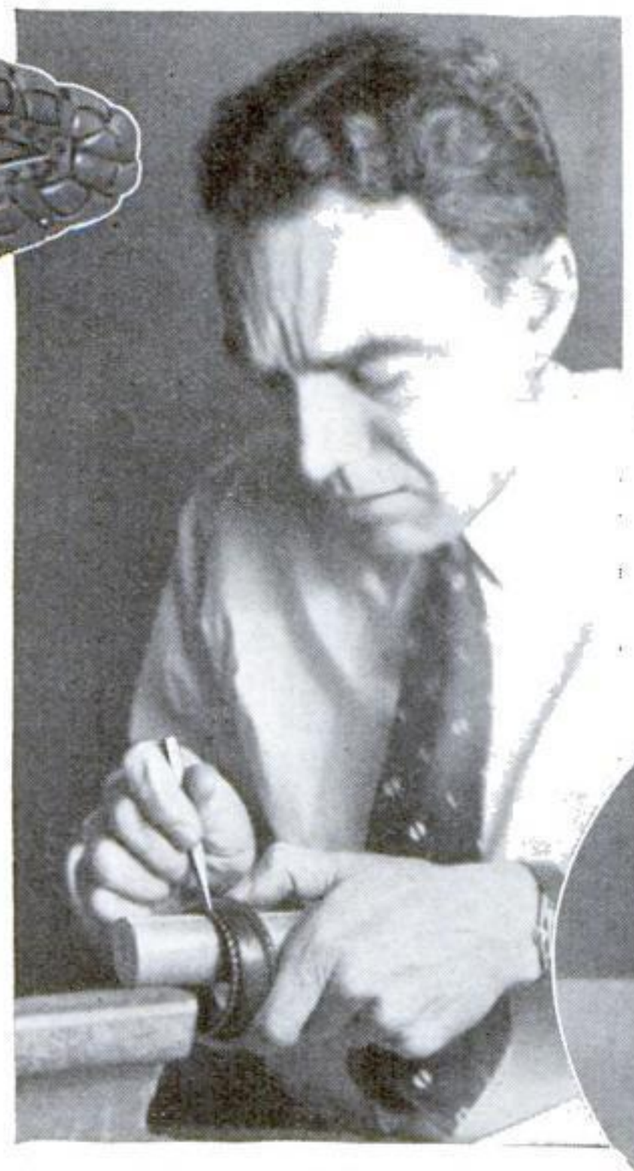
BENT motor-boat propeller blades can usually be straightened by using a pair of large C-clamps with much less danger of bending the shaft than would accompany any attempt to hammer them into shape. One end of a strong piece of wood is clamped to the blade near the hub as shown above, and with the other clamp the bent portion of the blade is drawn into position. If care is used in placing the piece of wood, the blade can be straightened without altering its twist and therefore its pitch, but a better result may be obtained by first whittling one side of the wood to the shape of the good blades.

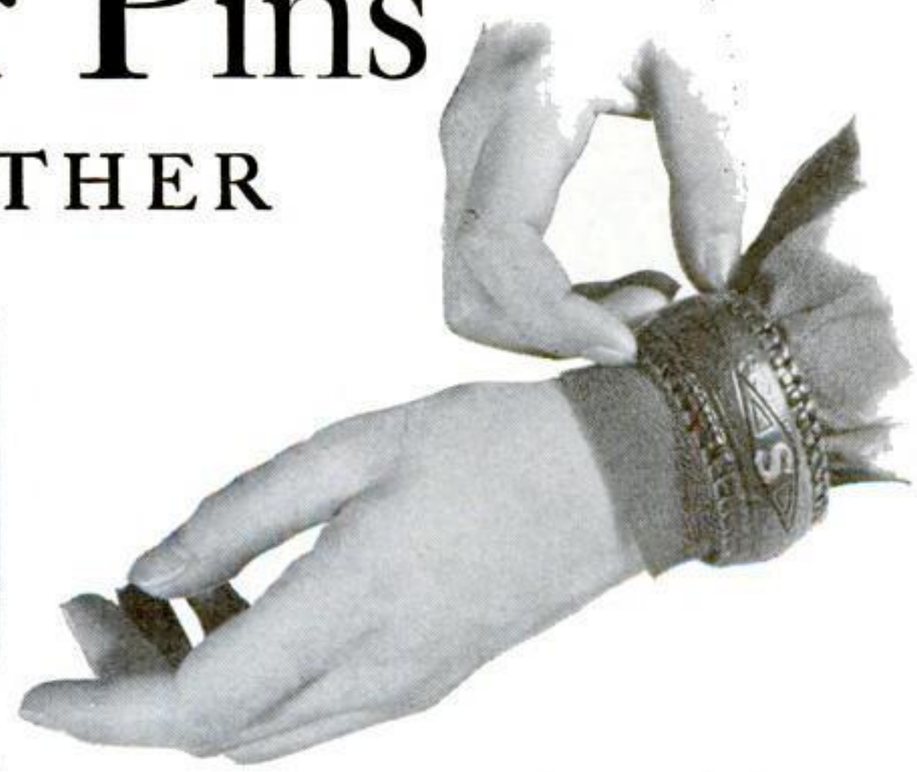
A repair of this sort will very nearly stop the vibration that would otherwise cause further damage to shaft or stuffing box; but the propeller, especially if it runs at rather high speed, should be removed as soon as possible for repair by an expert.—GUY A. RAFUSE.

Bracelets *and* Bar Pins

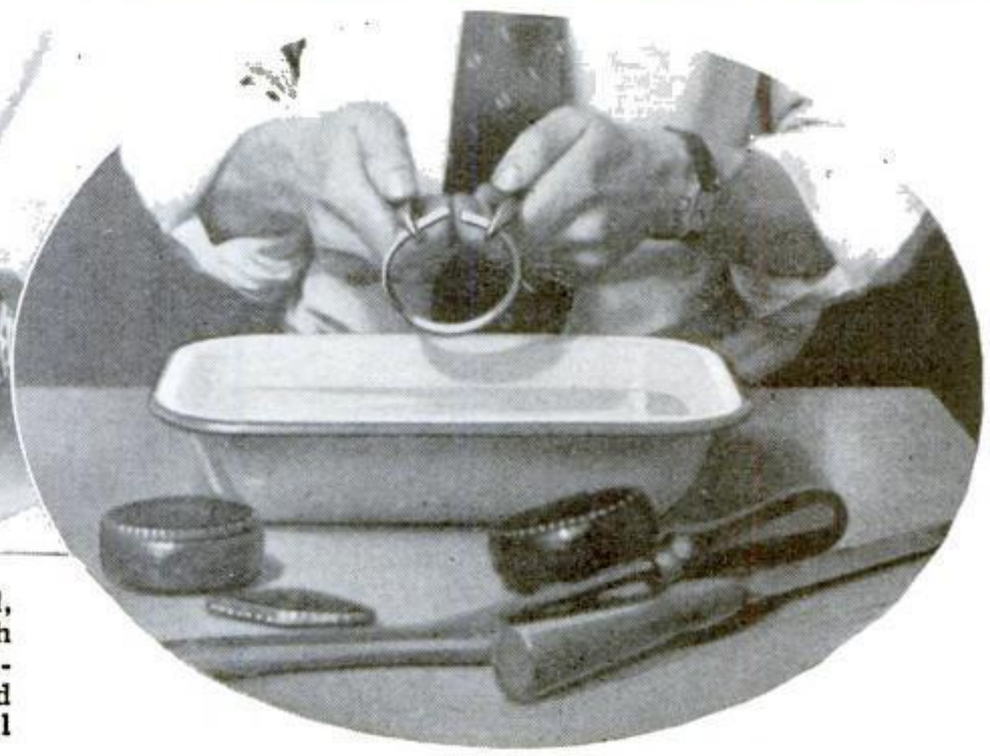
OF HAND-TOOLED LEATHER

Leather-covered bar pin with tooled initial and ornament. The edges are neatly laced





A celluloid insert within the bracelet gives it the required springiness. Note the perfection of the lacing



After the bracelet is assembled, lacing holes are punched through the bottom piece of leather as illustrated above. The way to bend the celluloid is shown in the oval

By Joseph J. Aultman

ATTRACTIVE hand-tooled leather bracelets and bar pins require but little time and expense to make. They are durable, light in weight, and can be prepared in a variety of colors to match any shade of wearing apparel. Two-tone effects are obtained, if desired, by using contrasting colors of lace and painting the initials or monograms with leather lacquer. Well-made costume pieces of this kind find a ready sale because of their novelty and individuality.

The materials for a bracelet are: 1 pc. tooling calf 1 by 7⅛ in. and 1 pc. 1 by 6¼ in.; a strip of celluloid ⅛ by ⅝ by 6⅜ in.; 1 pc. felt or leather suède for padding, ⅜ by 6½ in.; and 7 ft. of 3/32-in. thong lacing for the loop stitch.

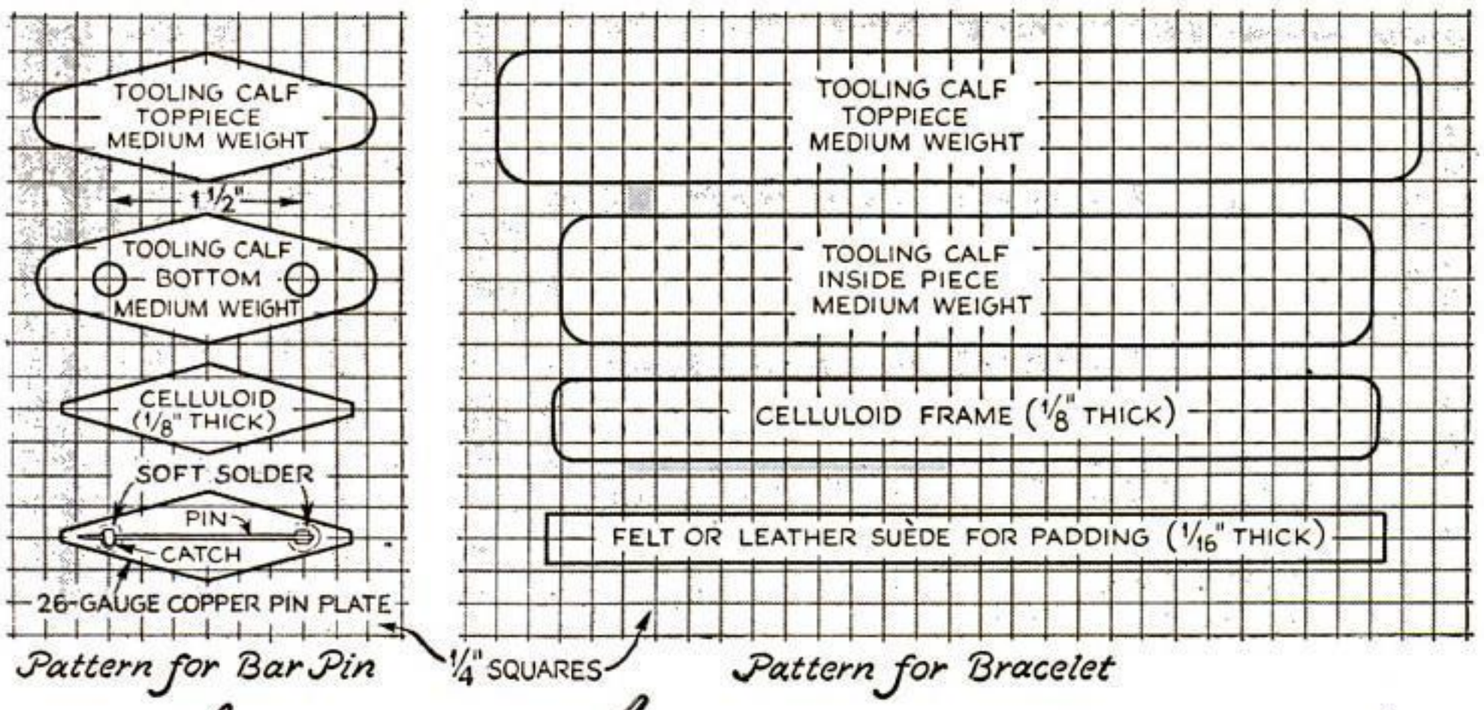
The first step is to sketch a simple design and initial or monogram on a piece of paper the same size as the upper or longer piece of tooling leather, allowing a ⅛-in. margin for the thong lacing. (You will save considerable time by using dividers to scribe guide lines on the leather for the lacing and borders.) After the leather has been dampened with a sponge or wad of cotton soaked in water, place it on a smooth hardwood surface and secure both the leather and the design sheet by means of thumb tacks at all four corners. Keep the thumb tacks close to the corners so the marks will not show on the finished work.

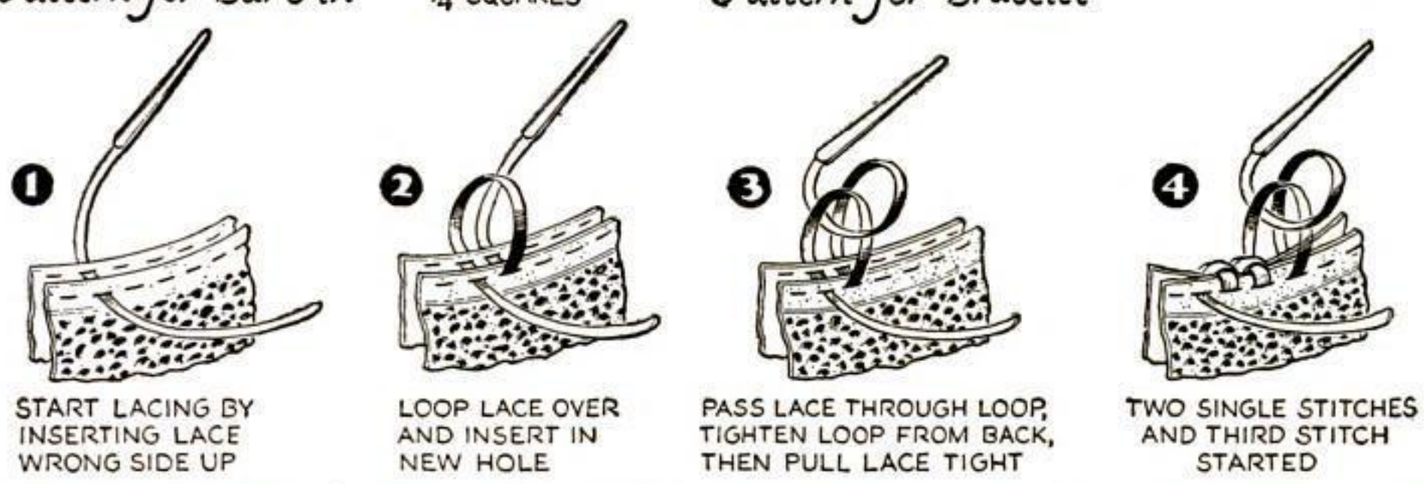
Transfer the design onto the leather by using a tracer or modeling tool. Keep the tool in a slanting position and work toward you, pressing lightly. Use a straightedge, if necessary, to guide the tool when following the straight lines. When the tracing is completed, remove the design sheet and go over the outline on the leather with the tracer or modeling tool. Press firmly until the design is embedded deep enough to stay. Keep the leather moist (not too wet) until the tooling is completed. The corners can then be rounded off by using a round metal disk as a guide for the knife. (Do not assemble the parts until the leather is dry, as leather will stretch out of shape when wet.)

Punch the tooled piece of leather with a single thong punch, making the holes ⅛ in. from the edge and about the same distance apart. The inside or shorter piece of leather is punched in the last operation before lacing, as explained later.

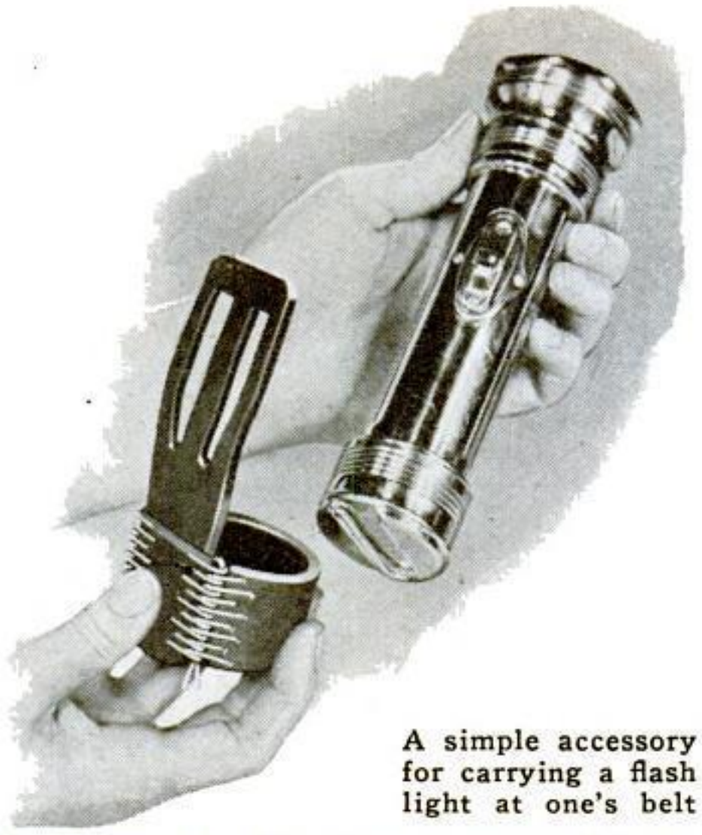
Before bending the celluloid strip, file the corners round and bevel the top edges. Then place it in a pan of boiling water and with the aid of pliers, form it into a bracelet shape, as illustrated. When bending, make sure the beveled edges are on the outside of the strip facing you. After it has cooled, the celluloid frame will have a springlike tension, making it easy to slip on and off the wrist.

Next glue the felt or suède leather padding to the *(Continued on page 101)*





How to lay out the various parts of the bar pin and bracelet, and steps in making loop-stitch lacing



A simple accessory for carrying a flash light at one's belt

BELTING USED TO MAKE FLASH-LIGHT HOLDER

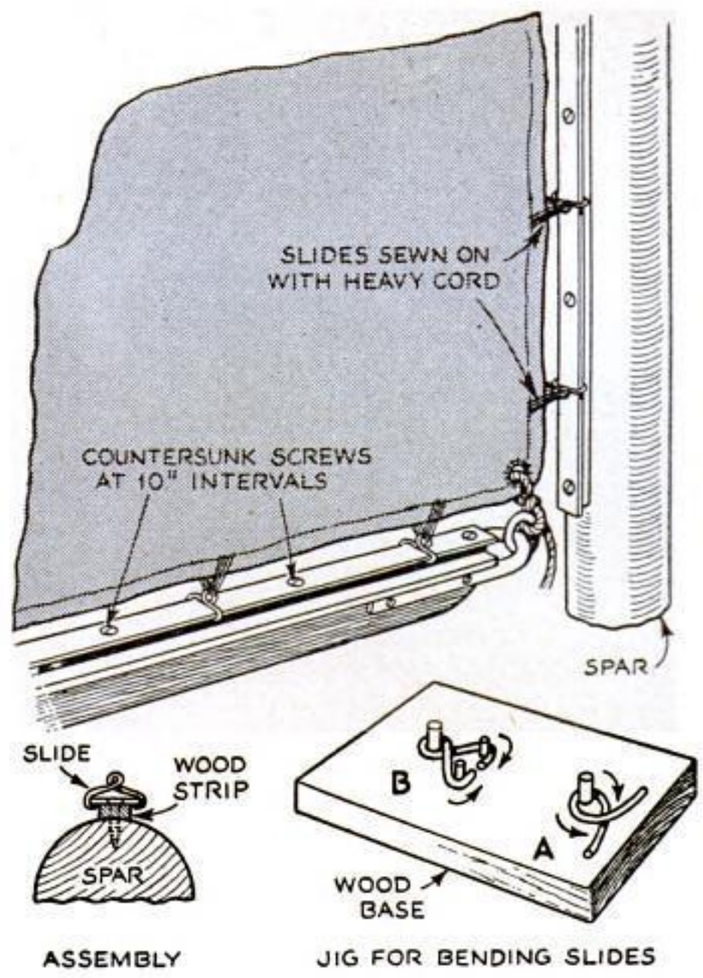
THE flash-light holder illustrated above was made from discarded flat leather machine belting and fastened with metal lacing. If preferred, the joints could be sewn or laced with leather thongs. The slot in the ear piece fits over the belt of the person using the flash light.—R. B. W.

INEXPENSIVE SAIL SLIDES AND TRACK

OUR effort to build a sailboat at low cost resulted in the development of what we believe to be an original design of track and sail slides, the total cost of which was less than a dollar for a 16-ft. Marconi-rigged boat. The track was made of inexpensive flat iron, drilled and countersunk at 10-in. intervals for wood screws, and screwed to the spar with a narrow strip of wood under it as shown. Care must be taken that all screws are countersunk, and that the wood strip is in the center of the track. The iron was given two coats of good varnish to prevent rusting.

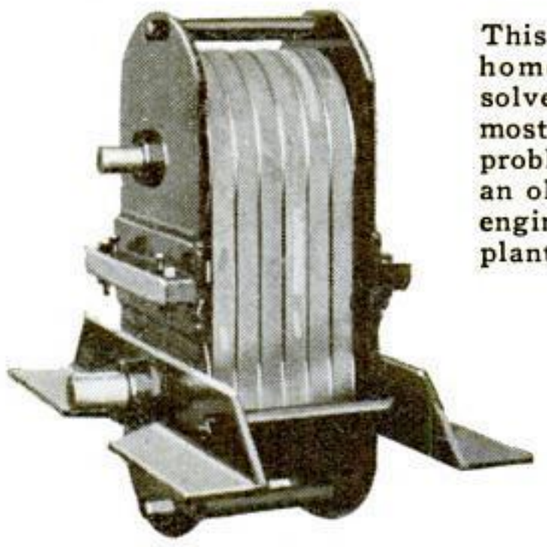
The slides were bent from 1/8-in. brass rod in a jig made by driving spikes in a wood block. The rod was first bent around *A*, then the loop placed on *B*, and the ends were bent to form the slide. The finished slide must be a loose fit on the track and must also clear the wood strip.

This design may be carried out with various materials, such as brass strips, galvanized iron, or black iron for the track, and the slides may even be made from common galvanized iron wire. Of course, brass is best.—H. L. LINDBERG.

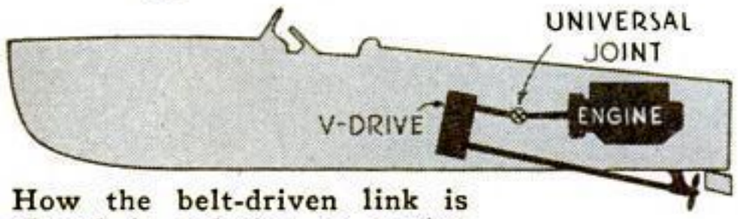


Slides are formed by bending thin brass rods around jig. The track is made from flat iron

SUPPLEMENTARY BELT DRIVE FOR BOAT



This economical homemade drive solves one of the most troublesome problems in using an old automobile engine as power plant for a boat



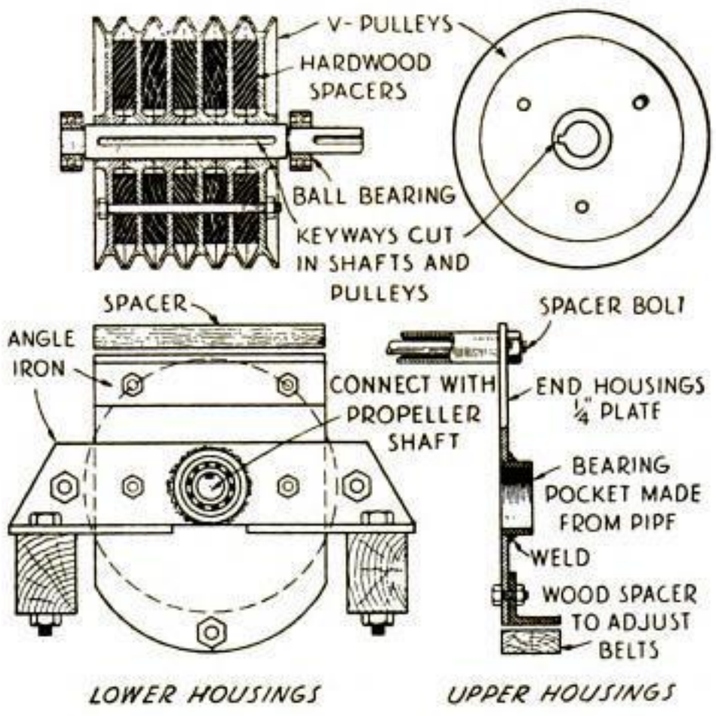
How the belt-driven link is placed in relation to engine

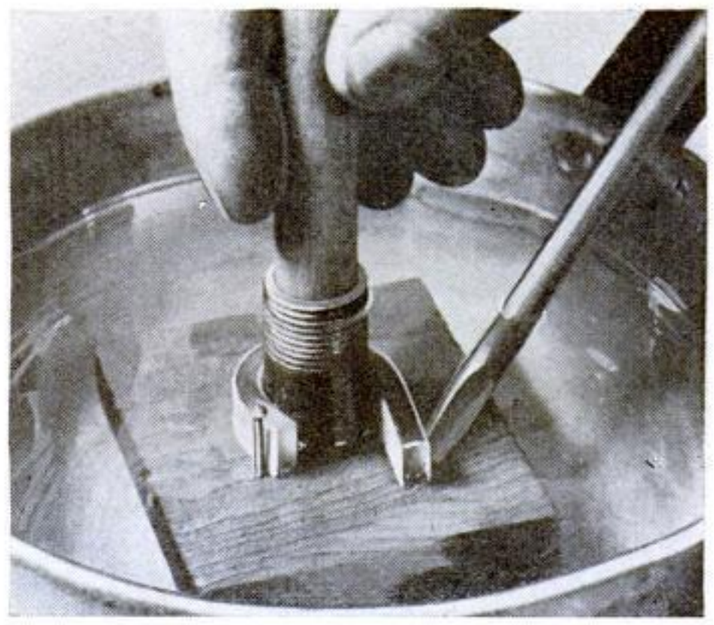
AUTOMOBILE engines are becoming increasingly popular for motor-boat use. An excellent engine may be obtained for from $15 to $30, but difficulty arises in devising an inexpensive connecting link between the engine and the propeller shaft. Most modern auto engines operate at higher speeds than are desirable to turn the propeller, so a supplementary drive is needed to get maximum results.

Chain and gear drives are difficult for the home boat builder to construct and prohibitive in price for the average boat fan to buy. The drive illustrated, however, is easily constructed at home, and costs comparatively little.

The size and speed of the engine must be determined first in order to select suitable belts and pulleys. The drive illustrated is built with six 7/8-in. automobile V-type fan belts, six 7-in. upper pulleys, and six 9-in. lower pulleys. The engine is a Packard light six, turning 2,200 r.p.m. A similar drive made for use with a model-A Ford motor has five 3/4-in. belts with both sets of pulleys 7 in. in diameter.

Belts may be purchased from any auto supply store; pulleys, at almost any large hardware store; ball bearings, from an auto wrecker. Shafts and housings may be made in your own shop. If all the work is done at home, the average cost of the drive is $12. Where part of the machine work is sent out, the cost may go to $20.



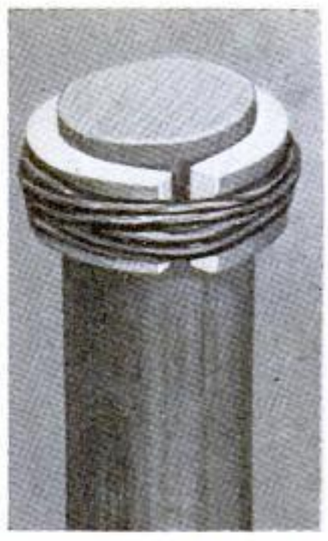


HOW TO BEND CELLULOID WHEN MAKING RINGS

TO MAKE it easier to bend celluloid toothbrush handles into perfect circles, when making celluloid rings, either of the methods illustrated will be found satisfactory.

In the one shown above, a short piece of pipe is inserted in a hole in a wood block, and a brad is driven into the block to secure the end of the toothbrush handle. Immerse the block and pipe in boiling water by means of a dowel driven into the pipe. The celluloid then can easily be bent around the pipe with the aid of a screw driver, and it will retain its shape.

In the method at the right, the celluloid is placed in hot water, bent into a U, and fastened around a wood dowel with rubber bands. Dipping the dowel into boiling water will soften the celluloid, and the rubber bands will draw it around the dowel to form a circle.—E. F. TROUP and W. T. FERGUSON, JR.



Softened celluloid bound around dowel

ASBESTOS HOLDS HEAT IN SMALL SOLDERING IRON

OFTEN when one is working on small motors and generators, the use of a small electric soldering iron is imperative in order to reach various inaccessible parts, yet it usually will not hold sufficient heat to complete the job satisfactorily. By placing an asbestos sleeve on the iron as shown in the accompanying photo, this

difficulty is overcome. Remove the sleeve after use as it might cause the heating element to burn out in the course of time.

FOR INFORMATION ABOUT OUR BLUEPRINTS, TURN TO PAGE 90.

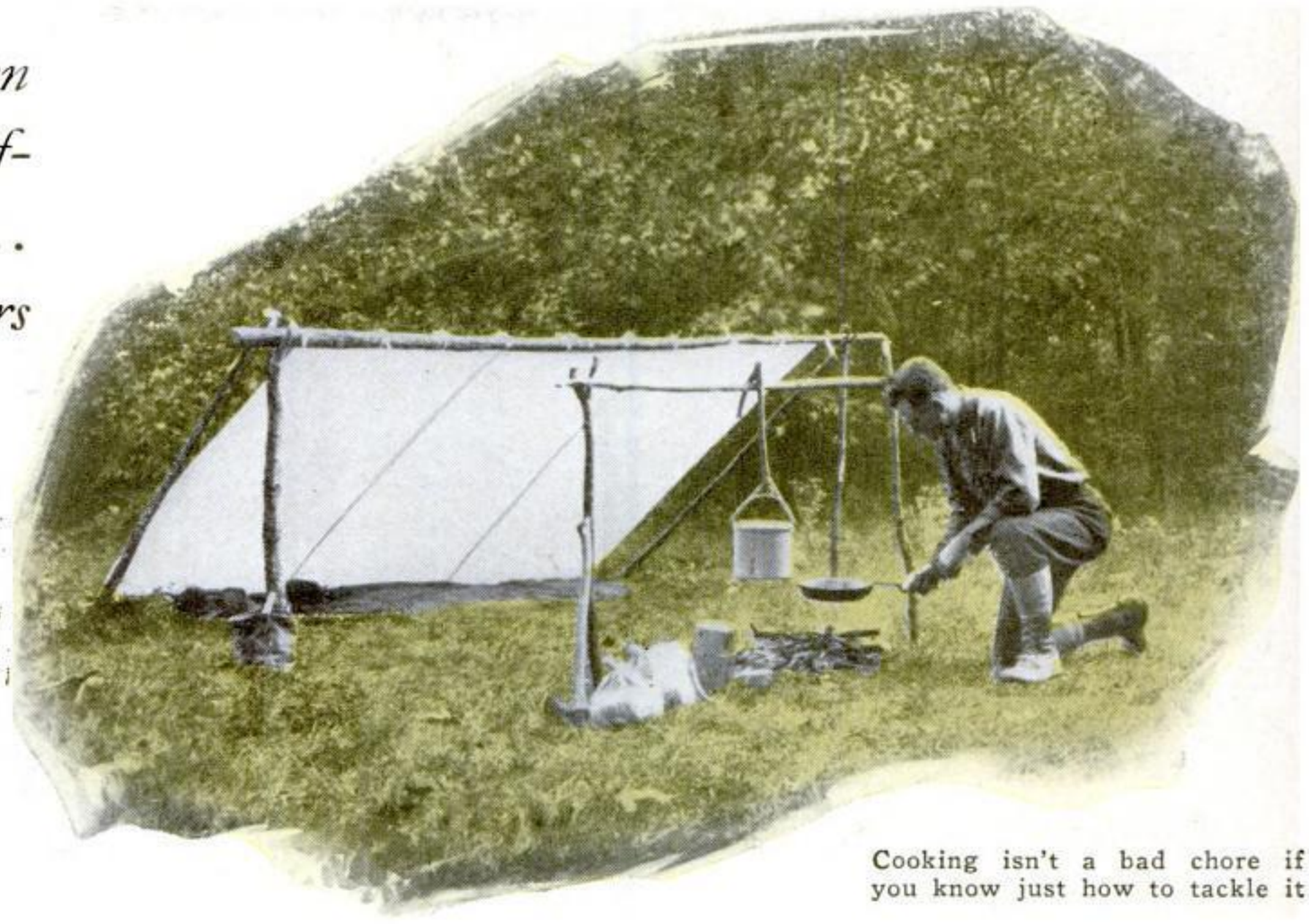
LABOR-SAVING Stunts *for* Camp Cooks

How to bake vegetables and even bread without an oven... A self-stoking fire for soups and stews... Bean holes... Seminole dinners

By

MAURICE H. DECKER

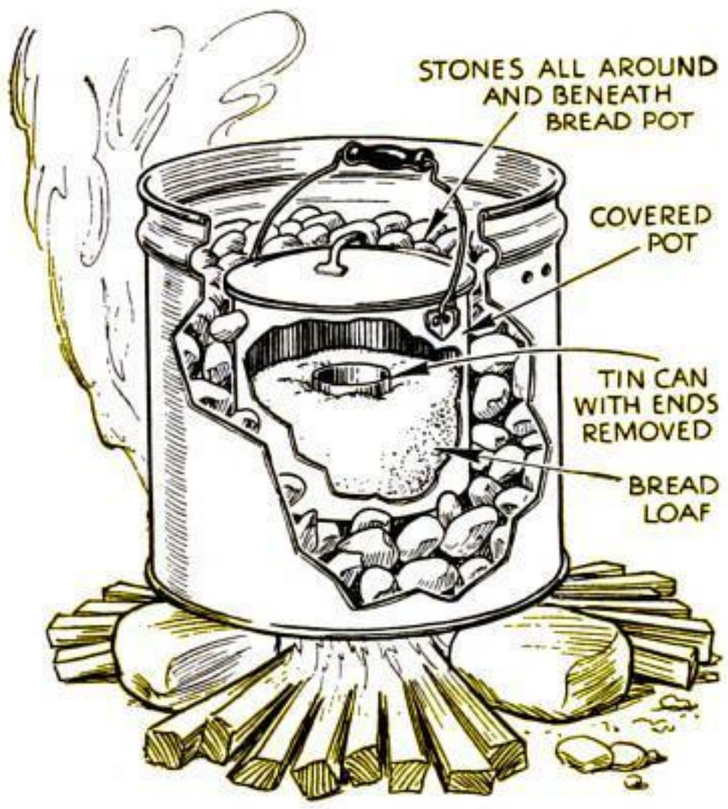
CAMPING AND WOODCRAFT EDITOR
OF "OUTDOOR LIFE"



Cooking isn't a bad chore if you know just how to tackle it

WHEN several men go camping together, the fellow elected as cook has the least fun of all. And the most work! I know because I've been that one many a time. At first I thought it was an honor, but that soon passed. I got tired out stooping over a smoky fire while the rest swam, fished, hiked, or just loafed. So I began to work out short cuts that would let me do my work more quickly. Now I don't mind being cook for I manage to have about as much time for fun as the rest. Here is how I work it.

Take fish first. Most camping trips are near water, which means fish meals in plenty. Cooking them can be either a tedious, painstaking task or an easy one. It's all in the know-how. First, the smart cook



With this arrangement a loaf of bread can be baked clear through over the camp fire

makes each angler clean his own catch. Then he cooks it some way that takes a minimum of attention. What I call the Seminole fish dinner is a good one.

You need a pot with a tight-fitting cover. Dig a hole in the ground 10 in. deeper and 10 in. wider than the pot. Build a fire in the hole and roll a dozen fair-sized stones on top of the wood to heat. Keep the fire burning one hour.

To serve four, lay four slices of bacon on the bottom of the pot. Put the meaty sections of fresh-cleaned fish on these, allowing ¾ lb. fish per man. On top lay an onion, carrot, and potato for each camper. Pour over all a No. 2 can of tomatoes and half a cup of water. Season with salt, pepper, and four tablespoonfuls vinegar. (Lemon juice is better if you have it.)

Dig out the hot stones. Set the pot on top of the ashes in the hole and pack stones about its sides, putting a thin layer of ashes between pot and stones to prevent the food from scorching. Cover the lid first with ashes, then with plenty of earth or sods to hold in the heat. Go away and forget it for about two hours. When you come back, dig out the grub and if you've ever tasted anything better, write me what it was for I want some myself.

There's a lot of bunk floating about on how to make bread in camp. Let me tell you how to bake bread without an oven and in a loaf that tastes like bread and not like flapjacks or burned toast.

Mix your dough from this recipe, all measurements being level:

3 cups flour
5 teaspoonfuls baking powder
4 tablespoonfuls cold grease
2 teaspoonfuls salt
Cold water to make a medium soft dough

Cut the top and bottom off a small can, such as a condensed milk tin, and grease it outside. Shape the loaf about this, standing the can erect in the center. Lay it in a greased pot with cover. Fill a larger pot or pail half full of small stones and set the covered pot down in them. Support the whole on three rocks over your fire. The can in the center of the loaf makes it bake deliciously clear through, not charred outside and doughy inside as so many camp loaves are. Have a good fire and test the bread with a sliver of wood after fifteen minutes. When the sliver comes out clean, you can be assured that the loaf is well done.

Maybe some wise guy suggests baked potatoes. Don't bat an eye. Say "sure" even if there isn't an oven in fifty miles. You can bake 'em, cowboy—bake any vegetable perfectly and with little work.

I know what you're thinking, but you're wrong. I don't plaster them with clay or mud. Such a mess and so much work! Just scrub the spuds and wrap each in a sheet of oiled paper. (Wise camp cooks pack a wad of this for various purposes.) Plain paper—not newsprint—will do in a pinch.

Get an old pail or can and fill it two thirds full of sand. Bury the wrapped potatoes in the sand and set the pail over the fire. If rocks are scarce, use three empty tin cans full of dirt for your triangular-spaced supports. Build up a good fire and go away and play. Two hours later wander back that way, kick over the pail and pick out the spuds.

You needn't stop with potatoes, either. You can use this *(Continued on page 103)*

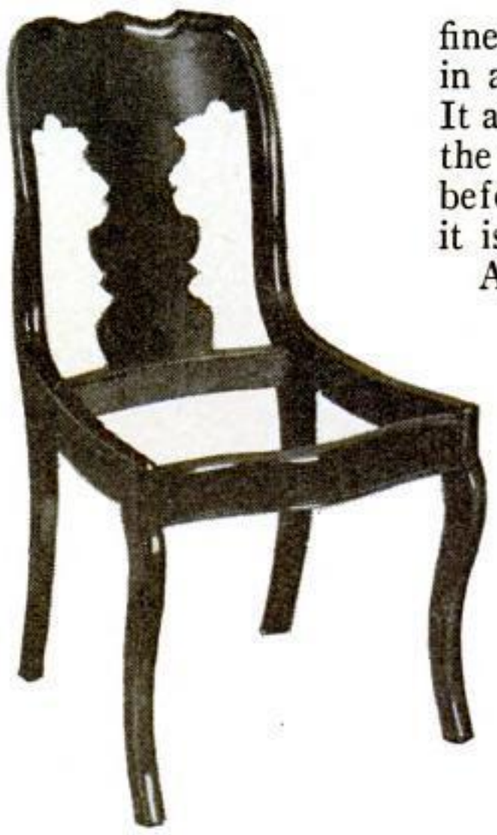
For stews or soups requiring long cooking, the fire is made in a hole so that sticks will feed down slowly

Varnishing the panel of a sideboard door. Stroke from the top of the panel around and halfway down the side, then from the bottom corner and halfway back. *Right:* Freshly varnished chair. Do the legs and frame first, then the head and center panels

TRICKS OF THE TRADE IN

Varnishing Furniture

By RALPH G. WARING



IN WOOD finishing—as, indeed, in all painting—there is nothing that so completely distinguishes the amateur from the professional as the manner in which he handles his brush.

All standard brushes have three portions: the bristles; the ferrule, which shapes and holds the bristles in permanent form; and the handle, of various shapes, which adds balance to the whole assembly and at the same time enables the brush hand to use the tool correctly and in a practical manner. Before reading any further, study the accompanying photos and note particularly the method of holding the brush.

Do not grasp the brush awkwardly by the handle, as so many beginners are apt to do. Fundamentally, all small brushwork, and much of the larger types as well, is done almost entirely with a short, quick, and easy flection of the wrist. There is scarcely any noticeable arm movement. Hence, grasping the brush by the handle defeats the primary method of brushing—working with a maximum of free wrist movements. Grasped as shown, *well down on the ferrule,* a brush is handled quickly and dexterously. In addition, the weight of the handle contributes a sense of easy balance, which cannot be obtained otherwise.

Next in importance is the method of stroking, which, if correctly applied in the beginning, soon becomes automatic. So many men, and women too, press the brush hard enough to distort the bristles, a practice which, if long continued, will produce a "fishtail" brush, the inevitable sign of the inexpert brush hand. A good varnisher knows that he must handle his brush in such a manner that the brush constantly tends to keep its full-chisel, varnish-flowing shape, enabling the material to flow out naturally from the undistorted bristles; while the brush handle, at a varying but generally low angle, definitely points in the direction of the stroke.

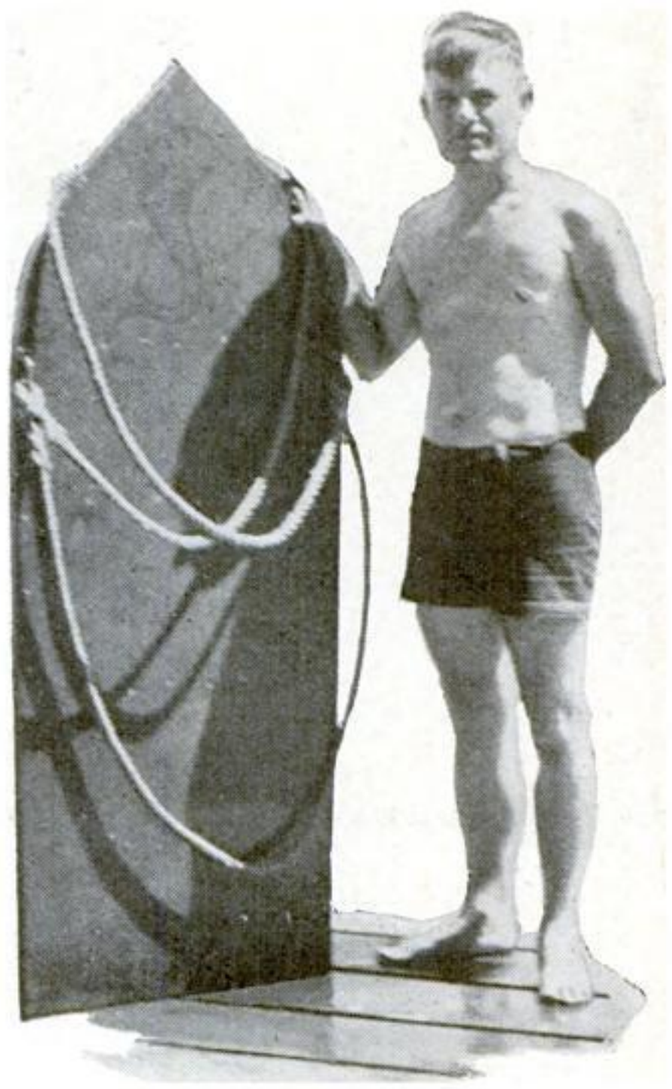
In many cases, during the quick and easy brush strokes used in working out a freshly varnished surface, the bristles are bent only a little; and when a panel is tipped off with long, easy strokes from ends to center where the brush is lifted off entirely to "feather" the stroke, the bristle tips alone are used and do not bend at all. This allows the brush actually to float on the tips of the bristles, performing that expert touch which "brings up" the newly applied varnish to a fine gloss, free of brush marks and bubbles, in a manner almost impossible otherwise. It also means fast, clean, sure work so that the varnish may still have time to flow out before it "sets" or stops leveling itself, as it is designed to do.

Again, in running panel lines and moldings, a certain technique is in order. In varnishing a door panel of a mahogany sideboard as illustrated, the stroke is first run around the panel to coat the panel margins thoroughly, and then the panel itself is quickly cut in until completely covered. This is done with an absolute minimum of strokes and frequent pauses to wipe the sides of the brush quickly and lightly on the strike wire of the varnish pot to remove any bubbles, before again tipping off the panel for that last expert touch which leaves it a thing of lasting beauty.

Next, the top and bottom cross rails of the door are cut in; followed by the hinge and lock stiles, on which long, running strokes leave a clean-cut appearance, free of cross lines from improper brushing.

The door edges are covered by "spatting" the sides of *(Continued on page 83)*

How the picking stick is used to remove a dust speck from the freshly varnished table top; and, at right, cutting in the half-round edge molding with the bristle tips, working from center to ends of each segment



By B. G. HATCH

A hollow board of this type is lighter and stronger than a solid aquaplane of equal proportions. It is stable in the water, yet well adapted for doing stunts

BUOYANT

Hollow Aquaplane

COSTS LITTLE TO BUILD

FEW thrills compare with a ride on an aquaplane behind a fast runabout. Of course, the aquaplane must be a good one, easy to manipulate, but stable. It must have the right hitch, the riding angle must be correct, and there must not be too great a drag for the power available. To meet these conditions at minimum expense for materials, a hollow board like that illustrated will be found satisfactory and at the same time comparatively easy to build. The materials cost the writer less than $2.50.

The board has a natural buoyancy of about 60 lb., due to its hollow construction, and this greatly reduces the initial drag at starting. It consists of a frame, made of 1 by 2-in. strips of spruce, cedar, or white pine, shaped around cross ribs to a conventional boat shape. The frame strips are rabbeted on upper and lower inner edges to take a ¼-in. waterproof (that is, casein-glued) three-ply fir covering, top and bottom. The edge strips and rear rib are of uniform depth, 2 in. The three intermediate ribs are flat on top and flush with the lower surface of the rabbet in the frame. This results in a flat top or deck on the finished aquaplane. The lower surface of the intermediate ribs, however, is dropped to make the board deeper in the center, and deepest at a point 18 in. back from the nose.

The aquaplane built by the writer is 2 in. thick around the edges, but 2¾ in. thick at the center of the forward rib, 18 in. from the nose. The other two intermediate ribs are 2½ and 2¼ in. deep respectively. Since the board will leak to some extent, each of the ribs is notched so that the water may be drained from a corked hole in the rear rib.

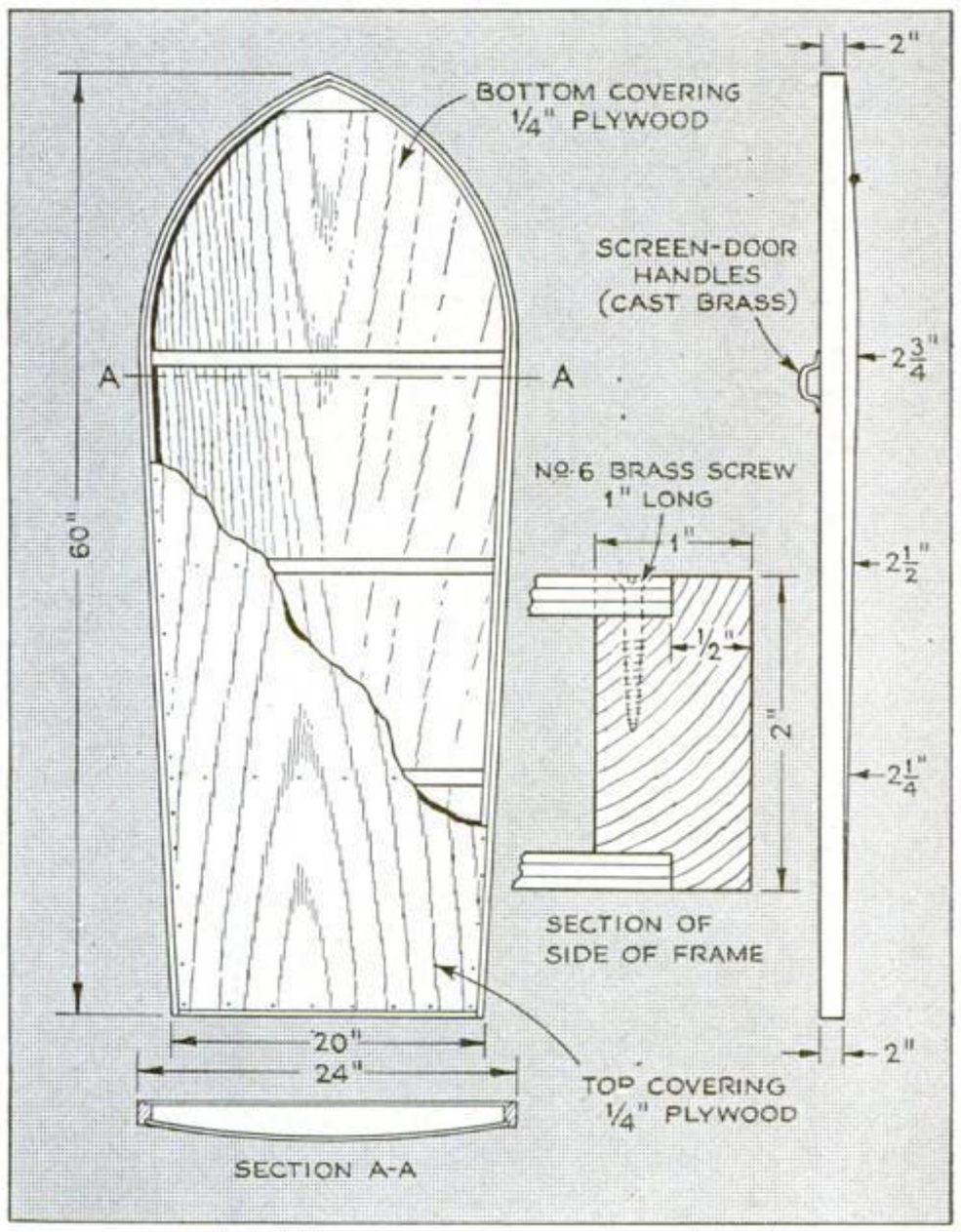
After the frame is assembled, the deck is fitted to the rabbet and set up in marine glue or white lead with 1-in. No. 6 brass screws, spaced 2½ in. apart. The board should then be clamped, top down, to a flat surface to prevent warping or twisting while the bottom is applied over the curved ribs. The inner surfaces of the entire board should be primed with white lead just prior to assembly to prevent absorption of water. After assembly the entire board may be given a natural finish with spar varnish, or primed with white lead and finished with colored lacquer, the edges being painted a contrasting color.

Two cast-brass screen-door handles are fastened to the upper edge, at the ends of forward rib, for a ½- or ¾-in. hemp rope pull-off bridle, to which the tow rope is attached. A ¾-in. hemp rope handhold bridle of suitable length is also spliced to the handles.

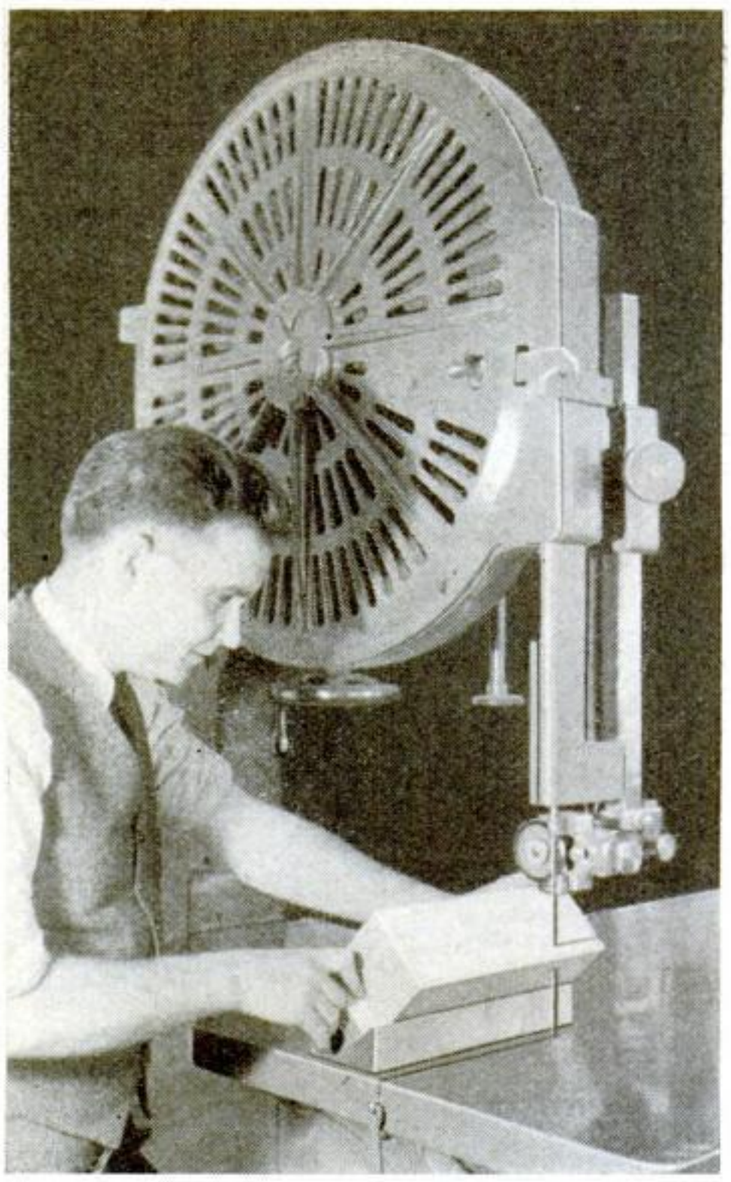
The best planing angle is as flat to the surface of the water as can be maintained without cutting into the waves. A standing position about 18 in. forward from the tail, between the two rear intermediate ribs, seems to be correct. By inclining the board to right or left, it may be skidded completely across the wake of the towing vessel; by inclining acutely—"kicking" the board—and pulling up on the bridle sharply, the board can be jumped clear out of the water.

This board has been used successfully behind a 16-h.p. twin outboard motor with a 14-ft. boat at 16 or 18 m.p.h., and behind a 16-ft. sport boat built by the writer from plans by William Jackson (P.S.M., July '32, p. 67, and Aug. '32, p. 78). The latter is powered by a 32-h.p. inboard motor with a 12 by 18 wheel, and pulls the board at better than 20 m.p.h.

Because of its shape, the board has a natural rise at the start and a greater degree of flexibility in the water, especially for stunts, than a solid board of equal proportions.



Top and edge views of the hollow aquaplane, a cross section, and an enlarged detail showing how the sidepieces are rabbeted

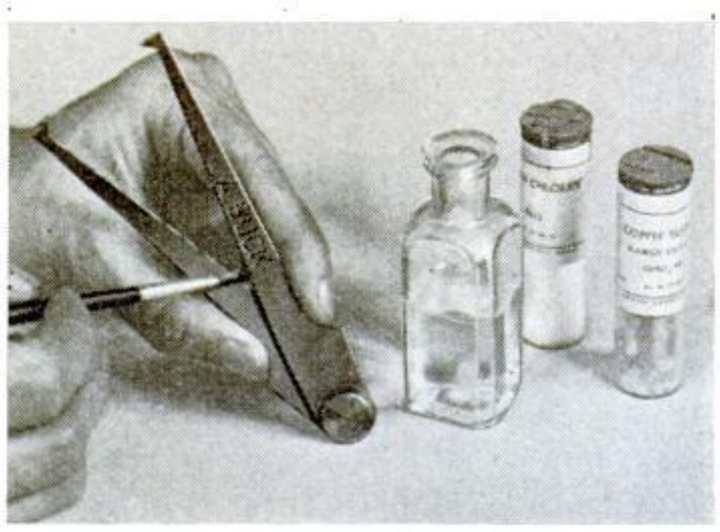


The square stock rests in a V-shaped wooden block while the square corners are sawed off

BAND-SAWING CORNERS OFF SQUARE STOCK

IF A BLOCK is made similar to the one illustrated above, it is not necessary to take the time or trouble to tilt the band-saw table when cutting off corners of square stock to prepare it for turning on a lathe. Dimensions are immaterial, but the angle should be 90 deg., and each side upon which the wood to be cut rests should make a 45-deg. angle with the base. The block shown was made from a piece 4 by 4 by 12 in.

A small block should be nailed in the angle at one end of the cutting block to serve as a stop and keep the work from slipping when it is being pushed into the saw.—W. T. BAXTER.



Marking initials on a tool with solution of copper sulphate crystals and salt in water

TOOL-MARKING FLUID CONTAINS NO ACID

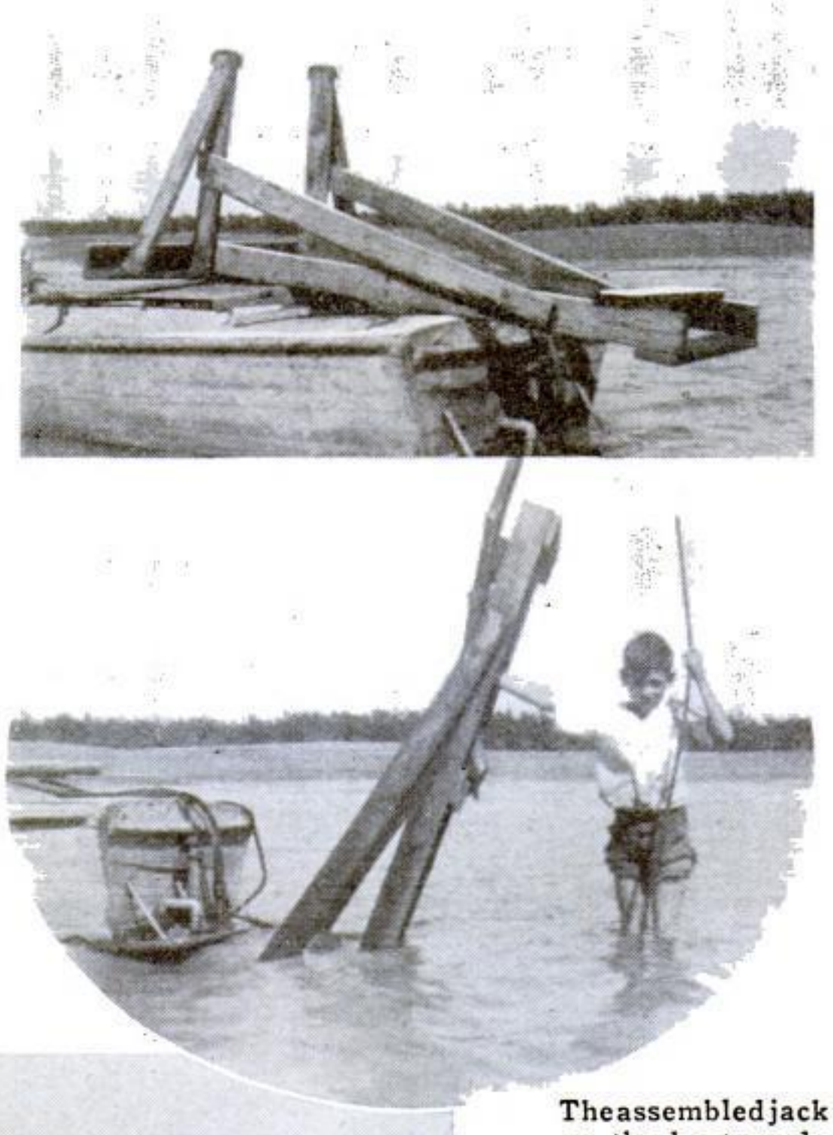
THE simplest tool-marking fluid that contains no acid can be made by dissolving 12 grams of copper sulphate crystals and 10 grams of salt in 40 c.c. of water, or approximately a teaspoonful of each of the chemicals in 2 oz. of water. The fluid is applied to the metal by means of a wooden stick, a pointed brush, or a sliver of quill from a feather.—R.W.

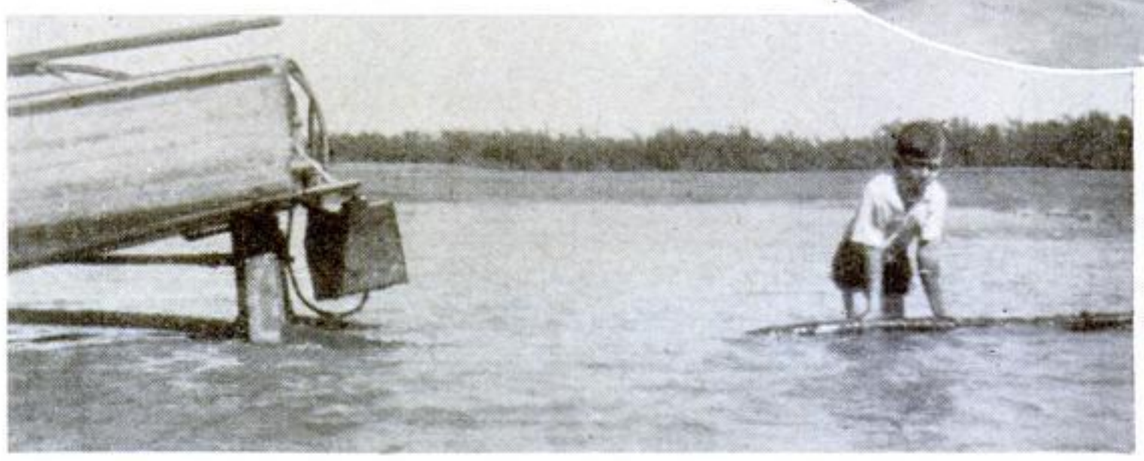
WOODEN JACK LIFTS BOAT FOR REPAIRS

MOTOR boats up to about 25 ft. in length can be raised at the stern for making repairs to the propellers, struts, propeller guards, and other underwater parts by the use of a homemade boat jack like the one illustrated.

The boat should be in shallow water close to a sand bar or bank so the propeller guard touches bottom. The bottom should be hard enough to prevent the jack from sinking, but if a hard bottom is unavailable, a wide board under the jack will provide a sufficiently firm footing. The uprights, 30 in. long and padded, are placed under the boat, and a pole is attached to the jack to give more leverage. A pull on a rope fastened to the end of the pole then raises the stern, as shown. In this case, a weight of 10 lb. attached to the end of the pole is enough to hold the jack down and the boat up. In fact, a 12-year-old boy is shown operating the jack, which illustrates the power of its leverage. The bow, of course, should be in water deep enough to permit it to go down as the stern goes up.

The jack is constructed of 1 by 4-in. oak throughout. Heavier pieces may be used, but that only adds excessive weight. Although the jack may be made any size desired, in this instance the short uprights are 30 in. long; the horizontal pieces, 6 ft., and the cross-pieces under the uprights, 4 ft. They should be put together with bolts, the uprights being about 20 in. apart, or wide enough apart to give ample room in which to work.—ALBERT SCHANTZ.





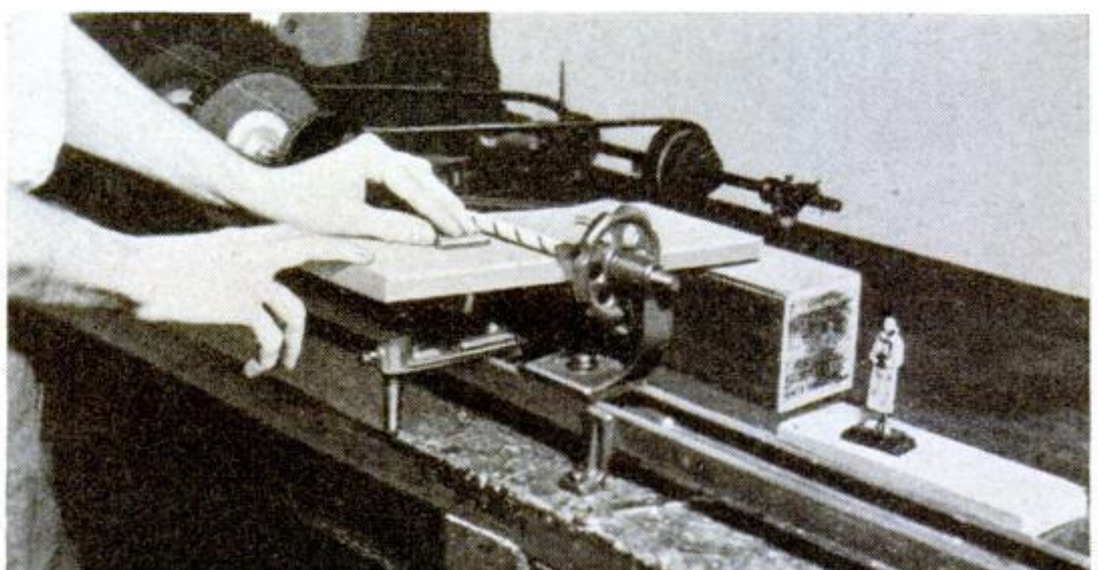
The assembled jack on the boat ready to be taken to a suitable beach for doing repair work; and, in oval, how it is put in place beneath the stern. A pole is fastened to the end of the jack and pulled down to raise the stern, as at left

SANDING ROLL SERVES AS A SHAPER

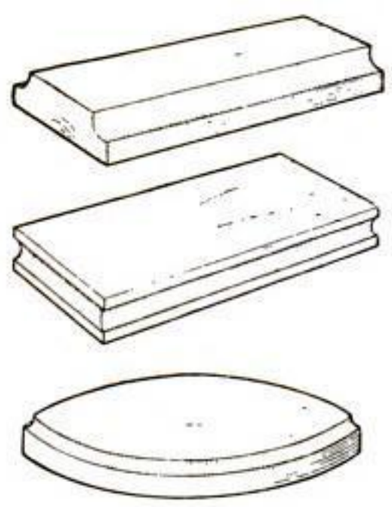
IN THE absence of a woodworking shaper, a bench lathe can be utilized to make simple cove-molding cuts in small stock. The method has proved entirely satisfactory for the quantity production of the shapes illustrated below, which were used as bases for photographs and photographic statuettes.

A dowel is turned in the lathe to a diameter that will give the required cove, and a strip of medium grade sandpaper is glued on spirally. A ¾-in. board serves as a table. At one end it is hinged to a block fastened on the workbench about 10 in. back of the lathe. The other end lies on the tool rest and can be raised or lowered to accommodate various thicknesses of stock.

In use, the stock is pushed squarely against the sandpaper-covered dowel until the desired cove is produced. Stock of circular or oval shape is handled by nailing a strip of wood on the table behind the dowel to form a stop, which regulates the amount of cut.—GERALD S. SEIDEL.



The stock, resting on a temporary table, is pushed against the roll



Three shapes molded in quantity by the author without using a shaper

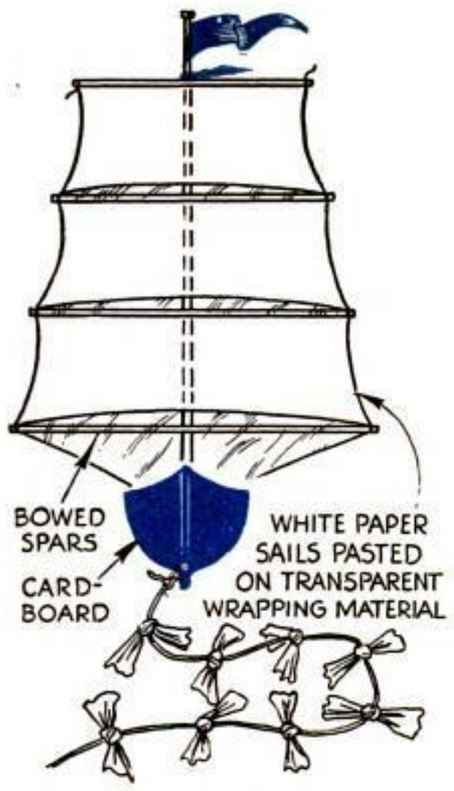
Suggestions for Making

KITES

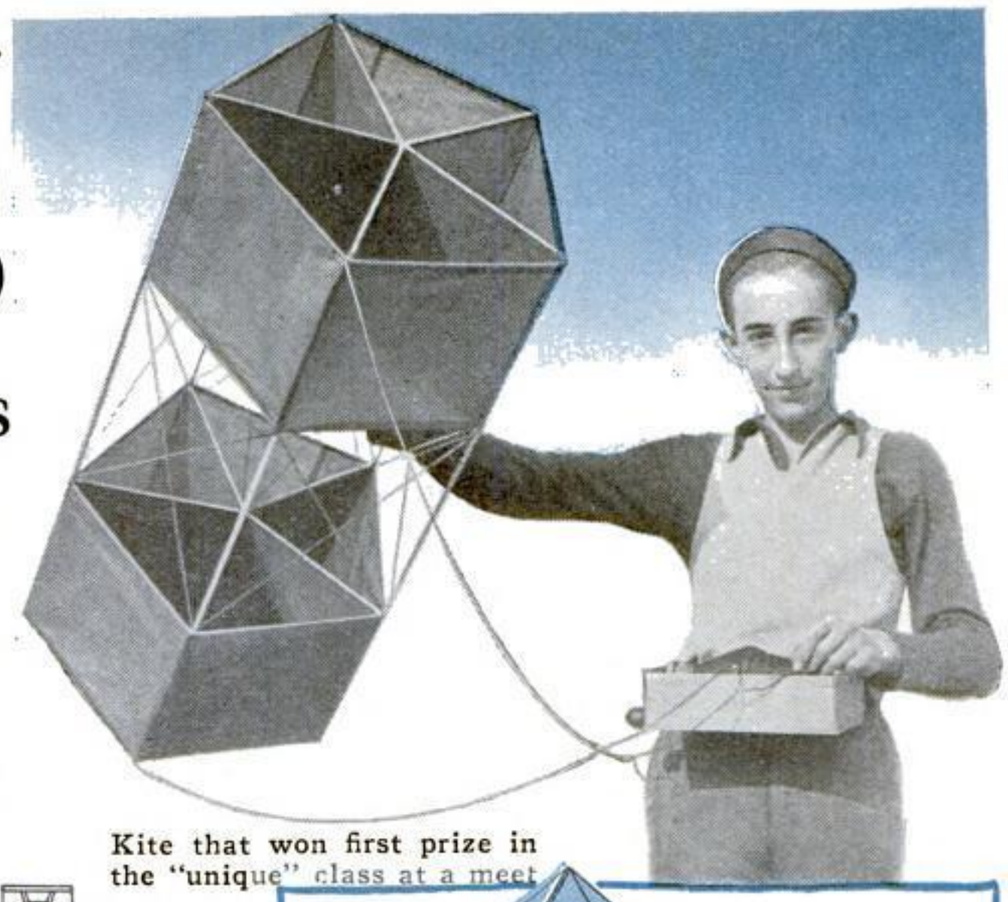
Messengers and Reels

LET your imagination and ingenuity have a chance, the next time you build a kite. Here are a number of suggestions. Note particularly the pentagon box kite by Elwood Yeager, of Pasadena, Calif., and the reel he uses when flying it. The sailboat messenger at the bottom of the page is another novelty; when it reaches the kite, its sail is automatically furled and it slides down again.

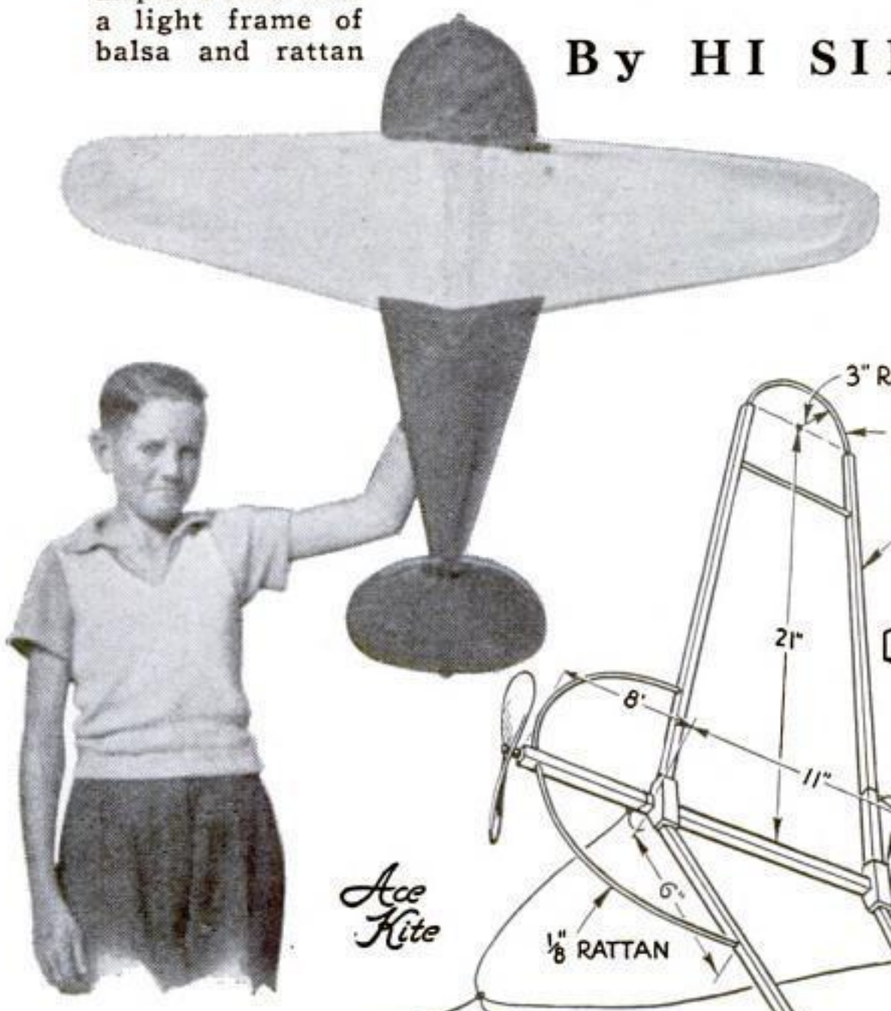
By HI SIBLEY



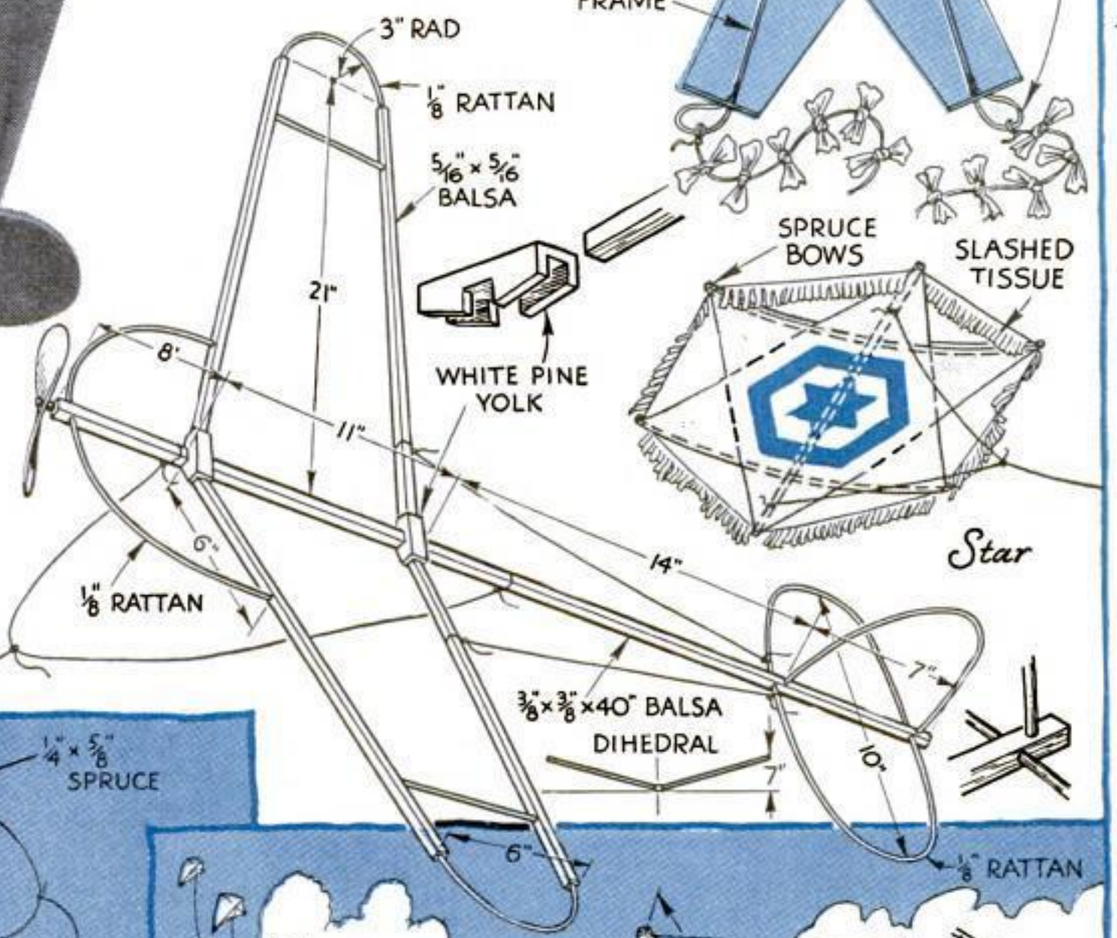
Below is shown an airplane kite with a light frame of balsa and rattan

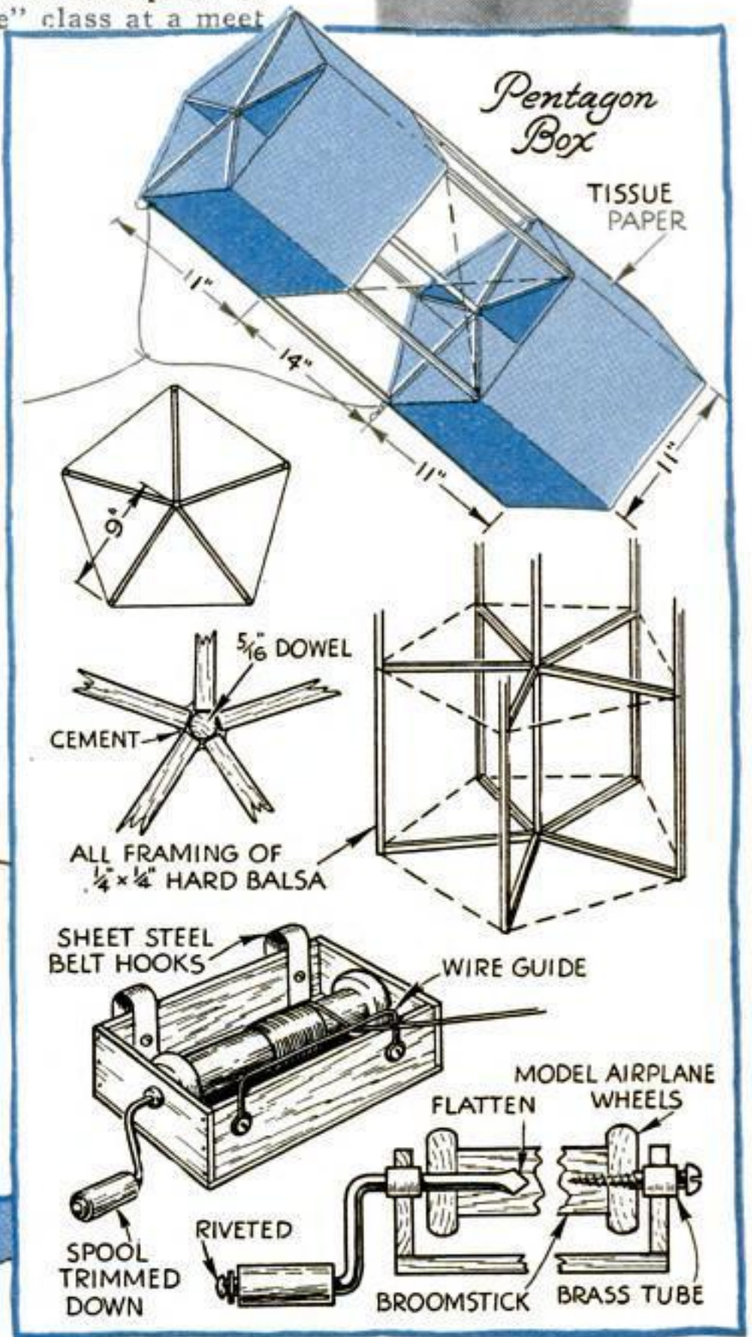


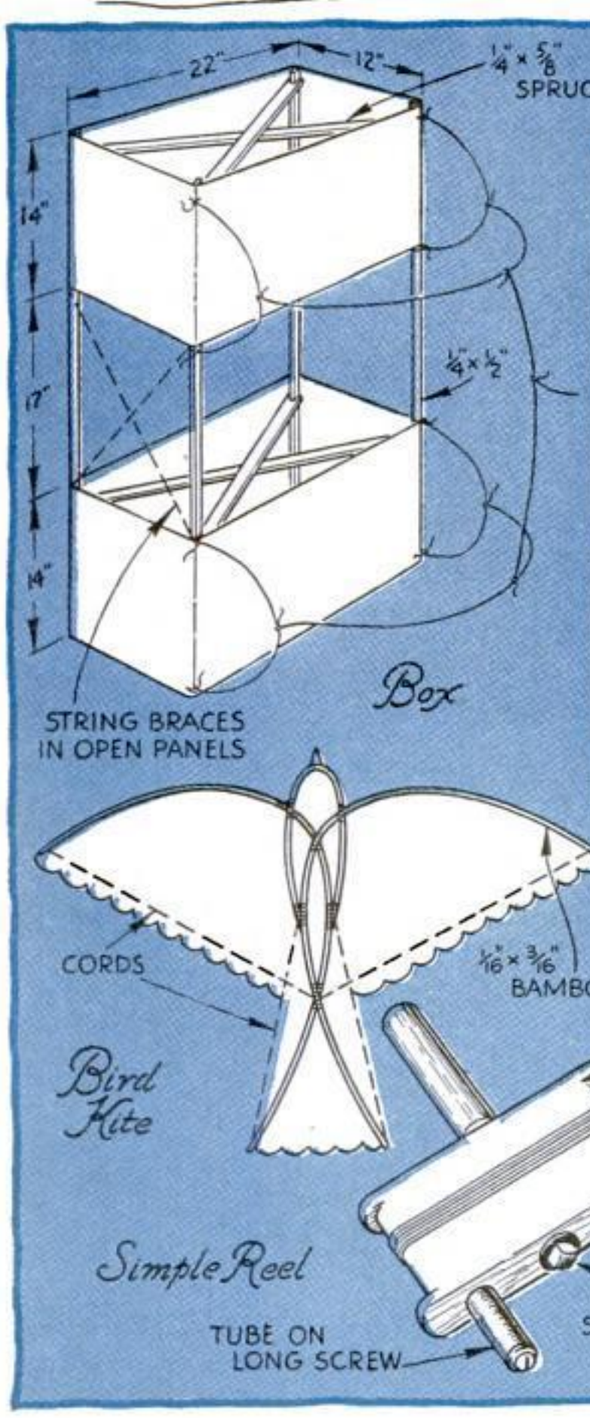
Kite that won first prize in the "unique" class at a meet

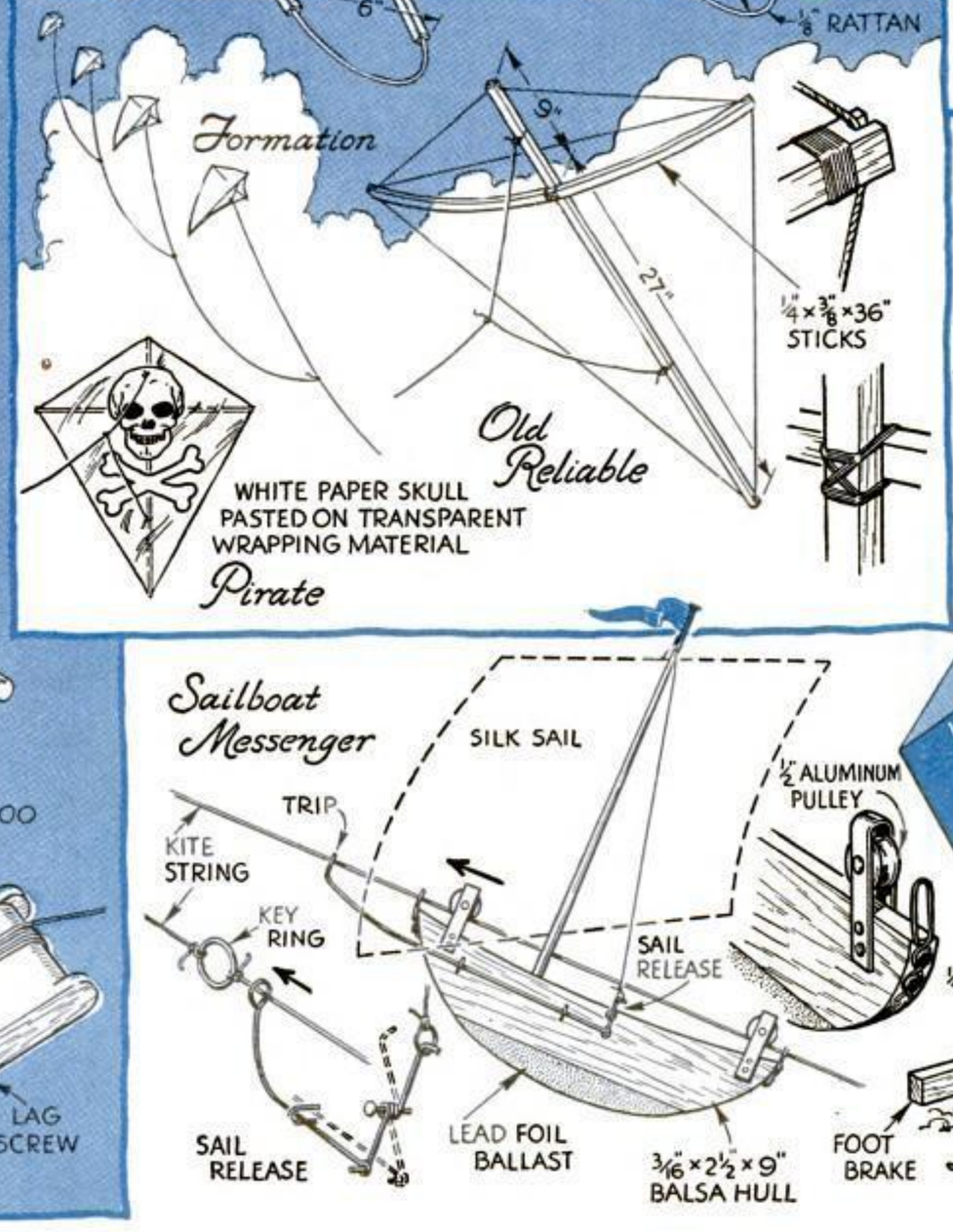


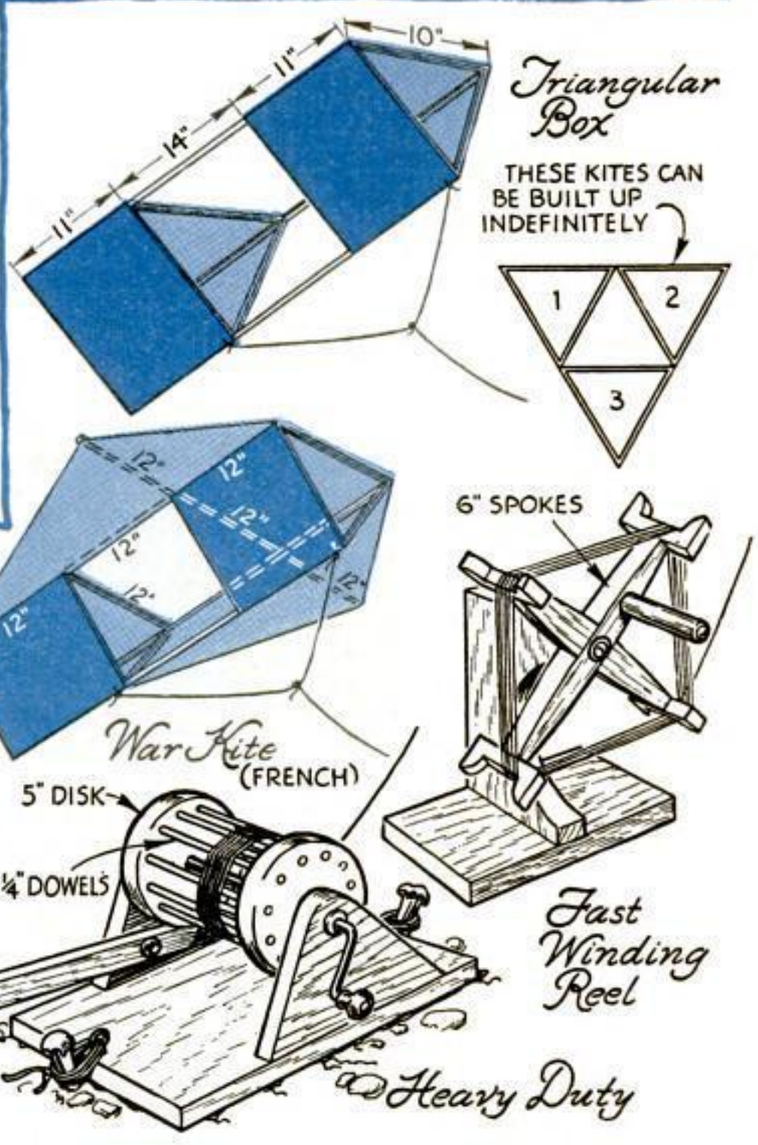
Ace Kite

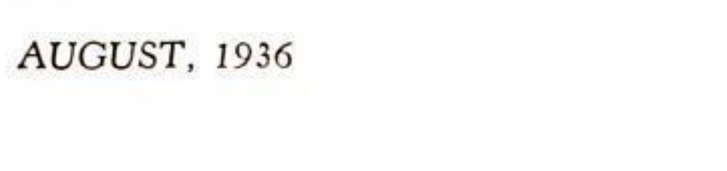












Paneled Cabinet

A QUICK WAY TO CONSTRUCT THEM ON THE CIRCULAR SAW

A NATIONAL HOMEWORKSHOP GUILD FEATURE

By Reginald O. Lissaman

•

EXTRA CUPBOARDS ALWAYS USEFUL

No house has enough cupboards, but it is easy to build extra ones. When two doors are used, as in this example, the so-called "meeting stiles" are usually left full width, but in fine cabinetwork, their width is reduced for appearance

MY OWN early experience and later observations of other men at work have led me to believe that many owners of small circular saws do not use them to the best advantage. This is possibly due to the dearth of simple, detailed information. Upon obtaining such a machine, one is presumably expected to be able to use it.

The accompanying illustrations have been prepared to help beginners use a saw expertly and, at the same time, show how to make inexpensive paneled doors for cupboards and cabinets, since the average home seems to be forever short of cupboard space. Constructing the cupboard itself seldom offers difficulty to the average home mechanic, but making a presentable door is another matter. During the last four or five years the writer has made and sold at least 300 doors of this type. Besides long since paying for the saw, this work has contributed no small sum to the credit sheet of the workshop.

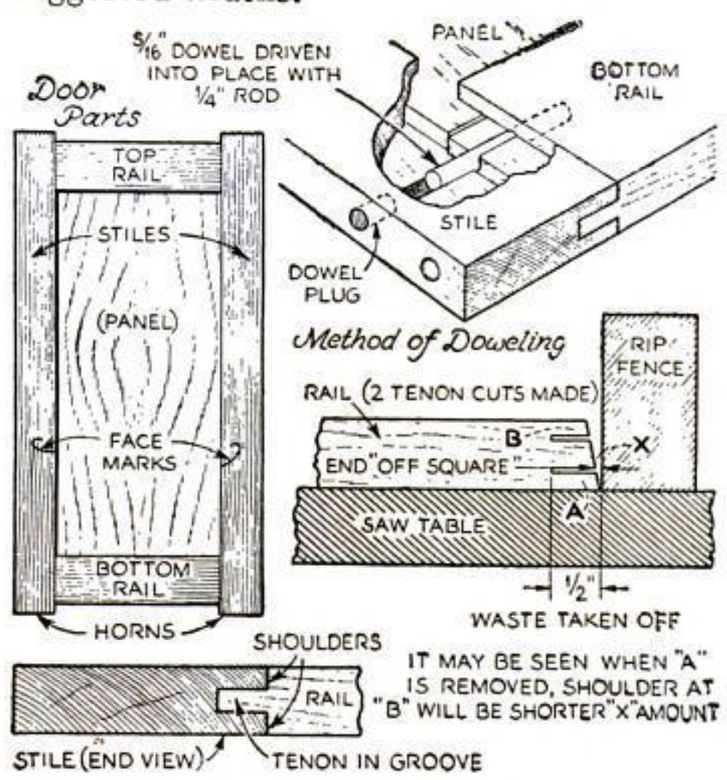
A well-conditioned saw blade is, of course, essential to fast and accurate work. In order to avoid waste as much as possible, I usually obtain but two sizes of stock—what is commonly known as "one by six" and "one by four." These measure ¾ by 5⅝ in. and ¾ by 3½ in. approximately. The one by six, ripped down the middle, provides an excellent width for the door stiles and top rails. The one by four makes the bottom rails.

Where the finished cabinet is to be painted, the wood I prefer is well-seasoned, straight-grained pine or spruce. For a moderately cheap natural or stained and varnished finish, select fir is excellent.

We shall assume that we are to construct a door 24 by 36 by ¾ in. Always follow the same system in obtaining measurements; this makes for fewer mistakes. The factory method is: Width first, height second, thickness last.

Cutting stiles and rails to size. The width of the side stiles governs the length of the cross rails, as will be seen by a glance at the drawing, so we must cut the former before cutting the rails to length. Cut off a piece of one by six about 38 in. long. Dress both edges square, and rip down the middle.

Place them with one dressed edge against the other and measure their combined width. They will measure, let us say, 5⅜ in. now, due to the loss by ripping and dressing. The width of the cross rails will be the door width (that is, 24 in.) minus the width of stiles (5⅜ in.) plus 1¼ in. for joints, plus ⅛ in. to allow for fitting the finished door. (In other words the door will be ⅛ in. oversize.) This sums up to 20 in. These rails are of the previously suggested widths.



The parts of a paneled door, a simple type of tenoned and doweled joint, and an exaggerated view to show why rails must be square

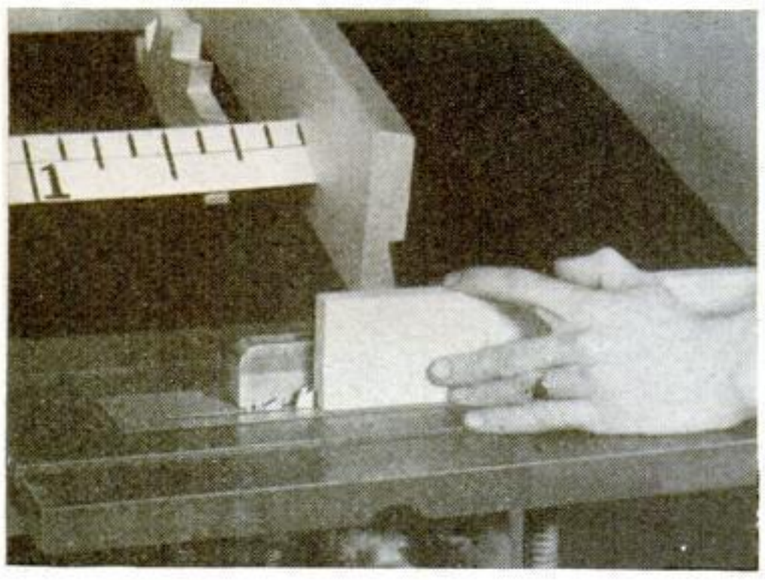


Fig. 1. The first grooving cut. The saw is set as shown by the large model in background

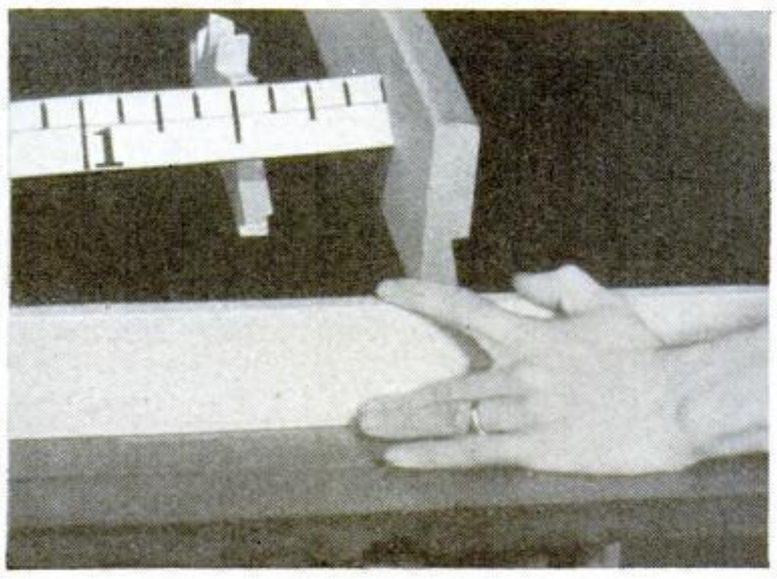


Fig. 2. Second grooving cut, with the setting again graphically illustrated by the big model

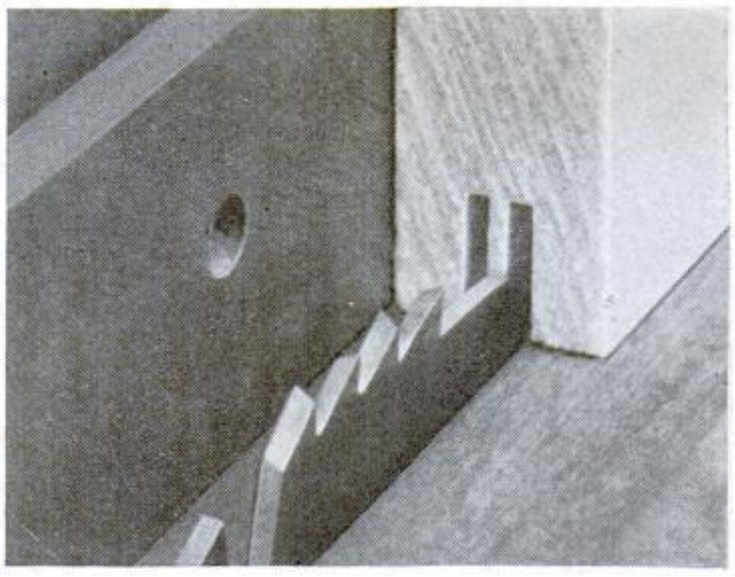


Fig. 3. A close-up of the third grooving cut. This is made to remove all the waste material.

and Cupboard Doors

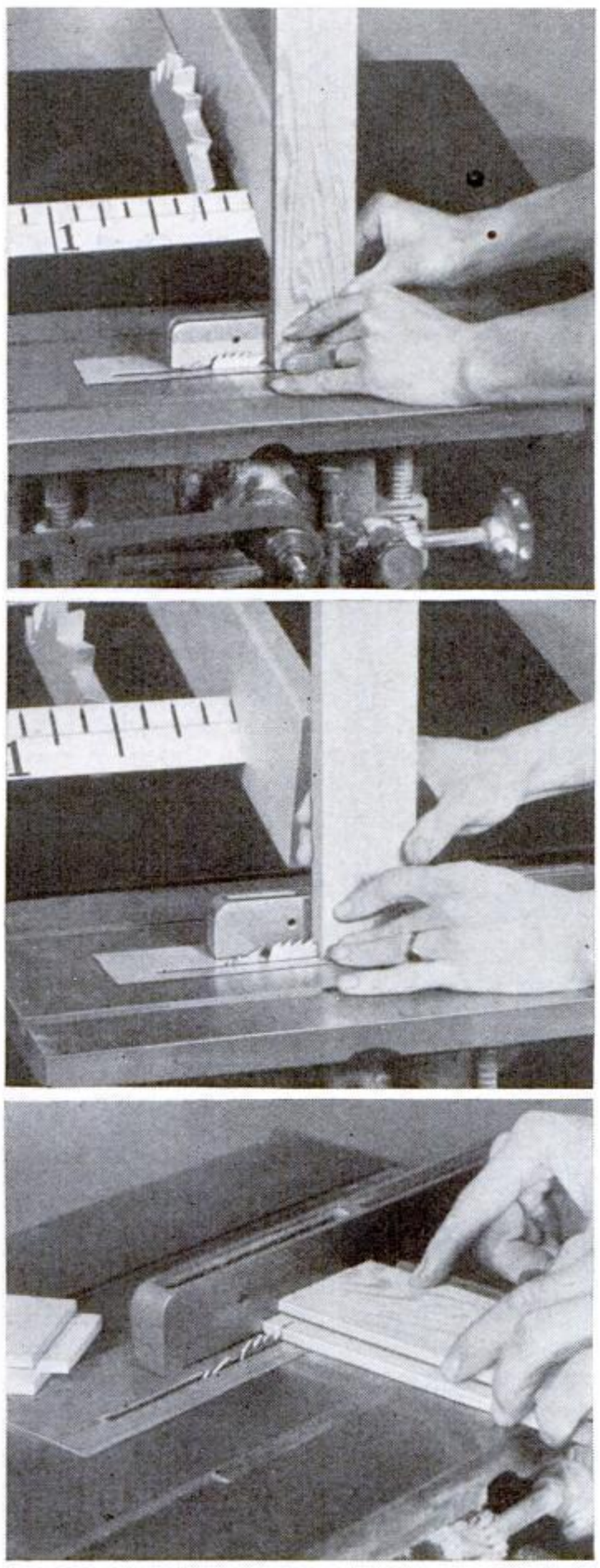


Fig. 4 (top). The first tenon cut. As the model indicates, the saw is set to "take off"

Fig. 5 (center). Second tenon cut. Be sure to test this as it governs the tenon width

Fig. 6 (bottom). Two cuts are then made at each end of the rail to form the shoulder

Mark all stiles and rails on the face side with a face mark running toward the face edge as shown in the drawings so you will be able to determine either at a glance. This is necessary since in all the grooving and the first two tenon cuts *all material must be moved over the saw with the face side against the rip fence.* Have also a scrap piece or two to run through the various saw settings to test the joint measurements and fitting. If I repeat some of these points later, it is for emphasis as they are important.

Grooving all members of frame in the face edge. Uniformity and speed of operation demand that each step be done on all parts of the door frame or frames at the time the saw is set for that particular stage of the work. This avoids continual setting and resetting of the tool and is one of the essentials of mass production.

When setting the saw for the various joint cuts, I have accustomed myself to the habit of mentally saying "take off" or "leave on." I shall follow this procedure here, as I have found it lessens the number of mistakes.

To make the first cut of the groove, set the saw so that it projects through the table 5/8 in. This cut is a leave-on cut—that is, we leave 1/4 in. of wood intact, as shown in Fig. 1. Measure 1/4 in. from the point of a tooth that is set to the right, or towards the fence; then bring the fence to this location and lock it. Run all members over the saw at this setting with the face edge to the blade and the face side to the fence. Keep them snugly in place as you slide them over the saw.

The fence is now adjusted to cut the other side of the groove. This is a take-off measure—that is, the measure is made from the tooth set to the left or away from the fence. A space of 1/2 in. is allowed from tooth point to fence (see Fig. 2). This cut may have to be varied to suit the actual thickness of the 1/4-in. three-ply panel. It is seldom exactly 1/4 in.

Adjust the rip fence now to remove the waste left in the groove as shown in Fig. 3. This may take more than one cut, depending upon the gauge or thickness of the saw blade. This leaves us with all members grooved.

Tenoning top and bottom rails. The tenoning is done only on the rails, so we shall now lay the stiles aside and place the former by the saw. The blade may be raised just a hair's breadth more than the previous setting so that it will cut 5/8 in. or a little oversize in depth. This is done to assure a clean corner at the junction of shoulder and tenon. Adjust the rip fence for a take-off measure of 1/4 in. to the tooth set away from it (Fig. 4). Cut the test piece first, running it on end, face side to the fence, over the saw as shown. (All circular-saw work requires the utmost care to guard against accidents, and this is especially true in regard to tenoning.) Try the test piece against a groove to make sure that the tenon is going to be correctly placed.

Figure 5 illustrates the second setting for the tenon. It is a leave-on cut, 1/2 in. being measured from the tooth set to the right, to the fence. This cut determines the width of the tenon, so it is imperative that this cut be made on your test piece. Remove the waste from both sides with a hand saw, and try it for fit into a groove. Adjust the fence very finely, either way, till the saw cuts the tenon exactly the right width. Then run each end of all rails, as for the first cut, over the saw, with the face side to the fence.

The width of the tenons now formed, we must remove the waste and form the shoulders. Lower the blade till it will just cut through the waste without touching the tenon when the rail is laid on the table as in Fig. 6. Adjust the cut-off guide for a perfectly square cut. Then adjust the rip fence for a take-off cut of 5/8 in. Place the rail against the cut-off guide and slide endwise till it butts against the rip fence; it is now in position to be pushed across the blade.

All the shoulders are cut in this manner, but it is well to remove the waste always from the face side first. The reason is shown in an *(Continued on page 91)*

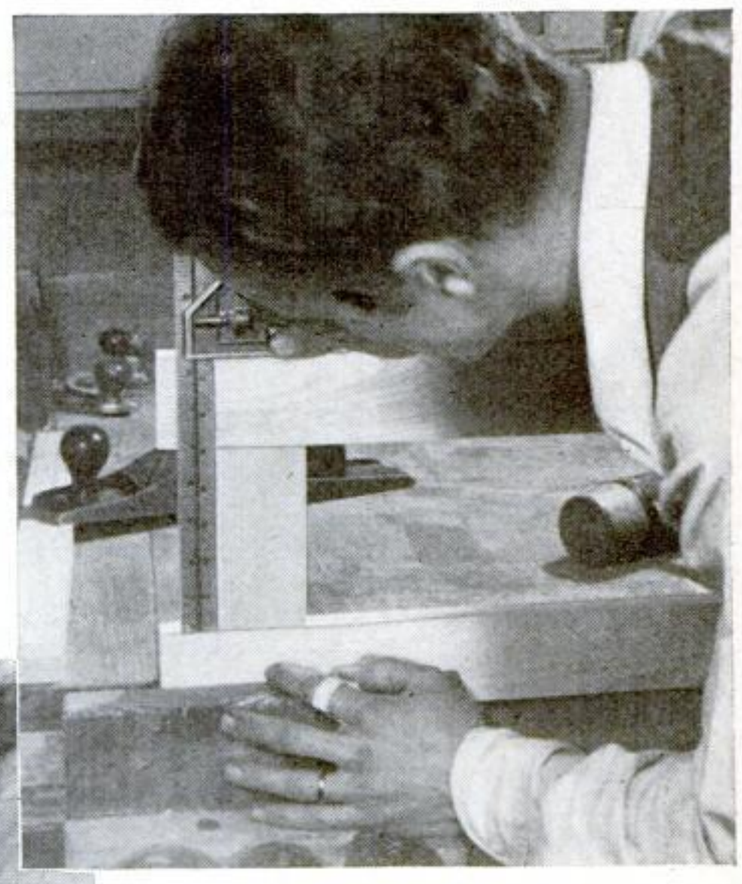


Fig. 7. When the rails and stiles have been grooved and tenoned, a trial assembly is made and all joints are closely examined for fit and squareness. At this time the frame is also measured to find the exact panel size

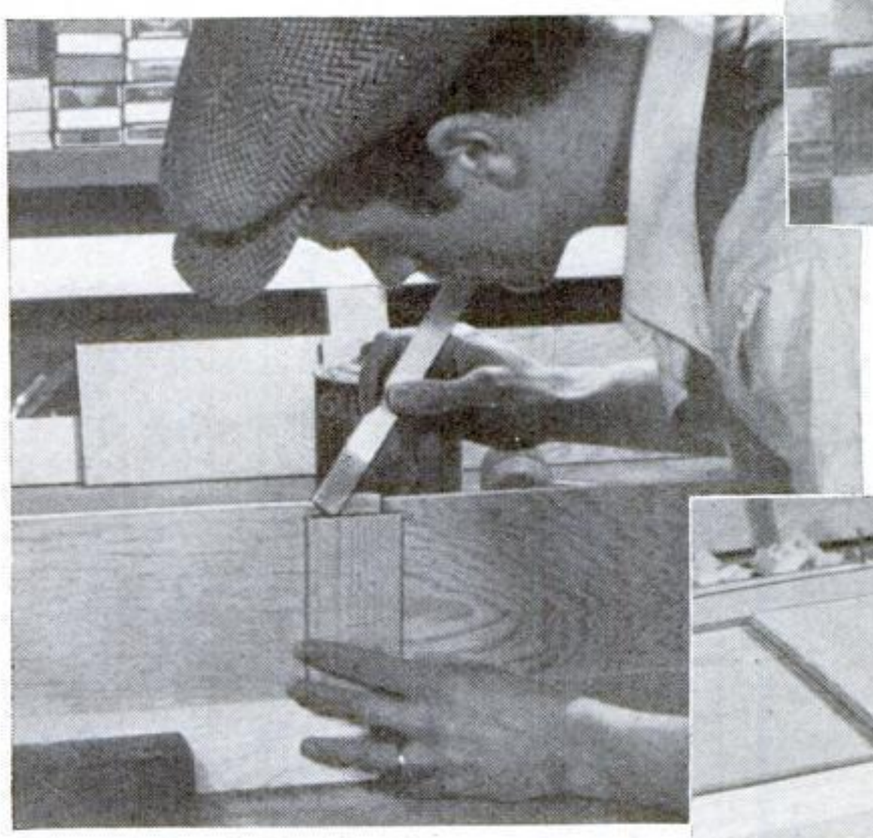


Fig. 8 (above). The door is next assembled with the panel. If all joints fit well, one stile is removed and glue is put on tenons, shoulders, and grooves. Then the stile is replaced and that on the other side treated in the same way

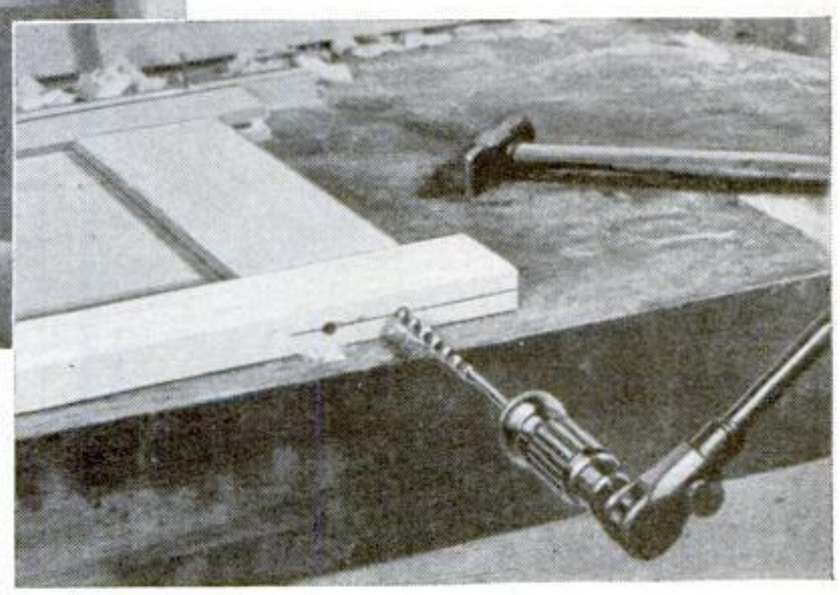


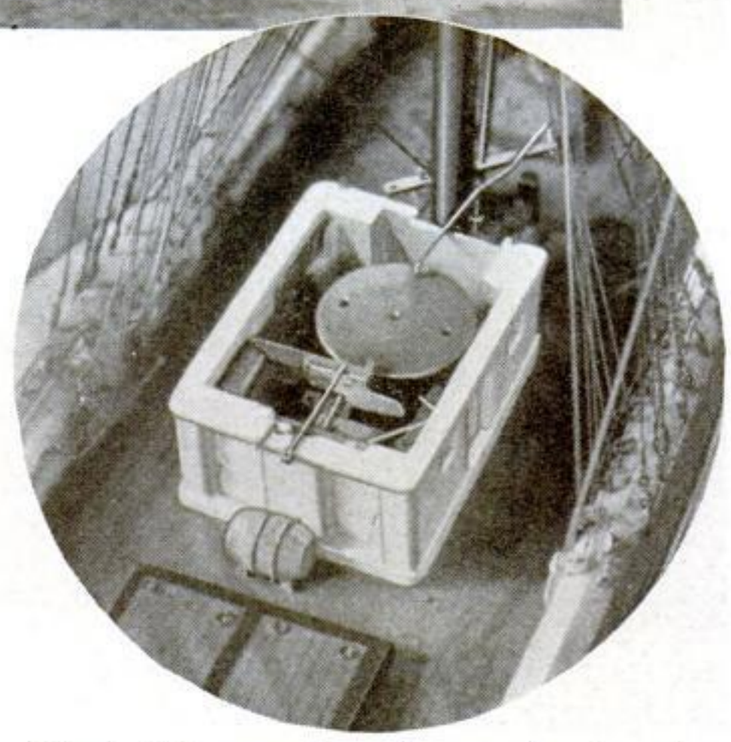
Fig. 9 (at right). Boring for the dowels

Automatic "CREW" Trims Sails ON SQUARE-RIGGED SHIP MODEL

You may think this is a full-size brigantine under sail, but it isn't. It's just a small model, sailed by a concealed clockwork device

The Yards Are Swung as if by Magic to Suit the Wind—An Old Alarm Clock Hidden in a Deck House Provides Power for the Mechanism

By **J. D. GARFIELD**



The deck house with roof removed to show the crank disk and other parts of the controller

IF YOU are one of the many thousands of readers who have constructed models of square-rigged ships, barks, and brigs, you have probably wondered if it would not be possible to make a model that would actually sail. Why is it that sailing models are almost invariably yachts or schooners and not squareriggers?

The answer, of course, is that if a square-rigged model comes up into the wind, it will not "come about" unassisted as model sailing yachts will, but is "taken aback" and driven backwards, stern first. On the old sailing ships themselves, this did not happen because the yards of the square sails were braced around by man power. Therefore it is necessary to devise some mechanism for a sailing model that will swing the yards in exactly the same way a crew of sailors would do it if the ship were full size.

One method of accomplishing this is suggested in the accompanying illustrations. It gives an amazingly realistic effect and has proved practically foolproof in action. The details would have to be modified to suit another model, but, in brief, the mechanism is as follows:

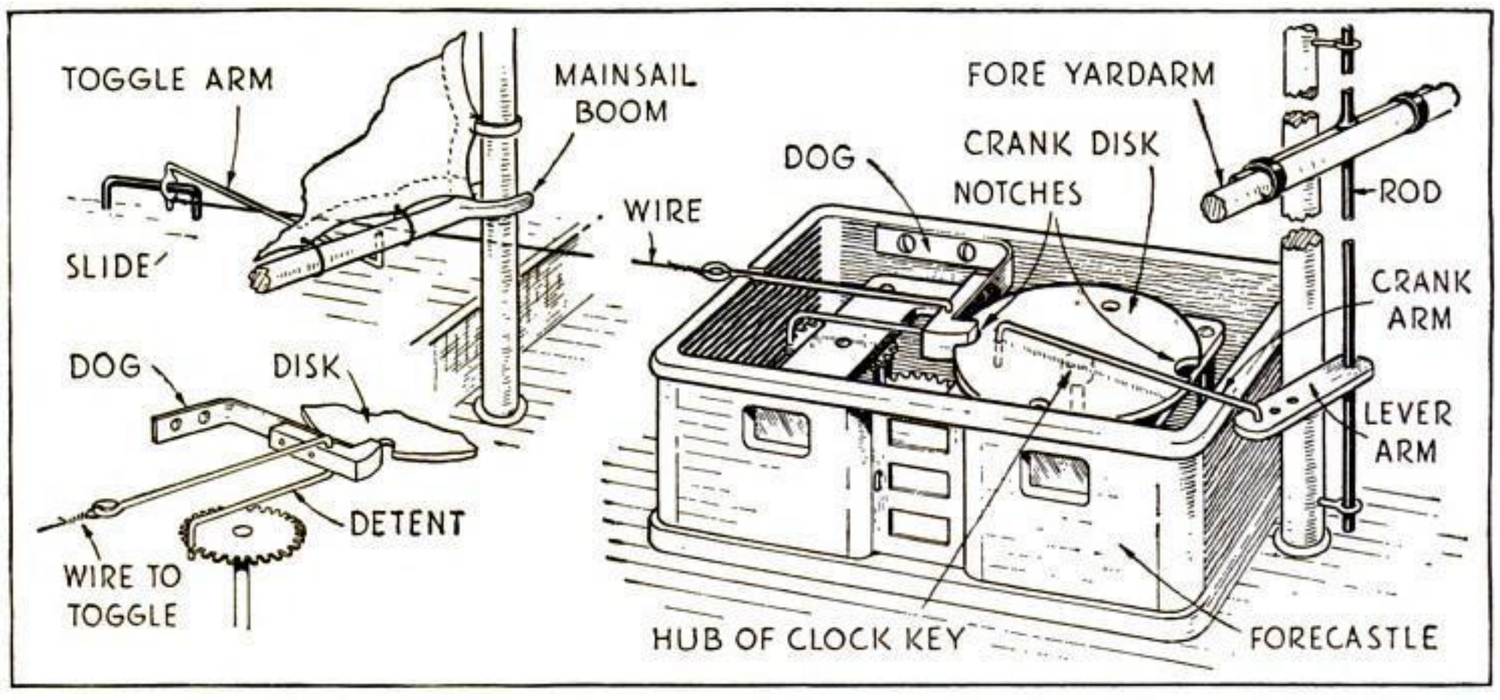
The winding key of an old alarm clock is removed and cut off so that a sheet metal disk may be soldered to it. Then the hub is screwed back on the spring arbor. The spring motor is installed in the forecastle house.

A slender vertical rod is placed just before the foremast, supported in top and bottom bearings so that it can turn. The yards of the square sails are attached firmly to this rod so they turn with it. Near the bottom of the rod is a lever arm with several holes, as shown. A wire crank connects this lever and the disk in such a way that half revolutions of the disk alternately push or pull the lever a distance sufficient to give the rod a quarter turn, more or less, thus swinging the yards and sails to the correct angles necessary to drive the model on either a port or starboard tack when it heads into the wind.

The swinging of the mainsail boom across the deck is what puts the mechanism in motion. In the model shown, the boom is a heavy copper rod to insure a more positive swinging over. One end of a wire toggle arm is pivoted to the boom as shown, and the other end slides back on a wire guide as the boom swings across the deck. In doing so, the toggle arm pulls a fine wire fastened, as indicated, to a U-shaped wire catch or "detent." The catch is looped around through a hole in the L-shaped dog and extends back to the last wheel of the clock-movement train, where a downwardly bent end portion of the dentent is adapted to engage this wheel for the purpose of instantly stopping the movement.

When the catch is drawn back, it simultaneously moves the dog out of the notch in the disk and releases the last wheel of the train. As the disk makes a half turn and swings the yards, the bent end of the dog rides on the moving edge and springs back into the second notch. The bent wire end of the detent simultaneously engages the clock gear and stops the motion. Thus the energy needed to wind the clock becomes, when the clock is running, the power required to swing the yards.

When the boom again swings back across the deck in the opposite direction, the entire cycle is repeated, and the yards are swung back to the position they originally occupied. The yards therefore move in unison with the mainsail.

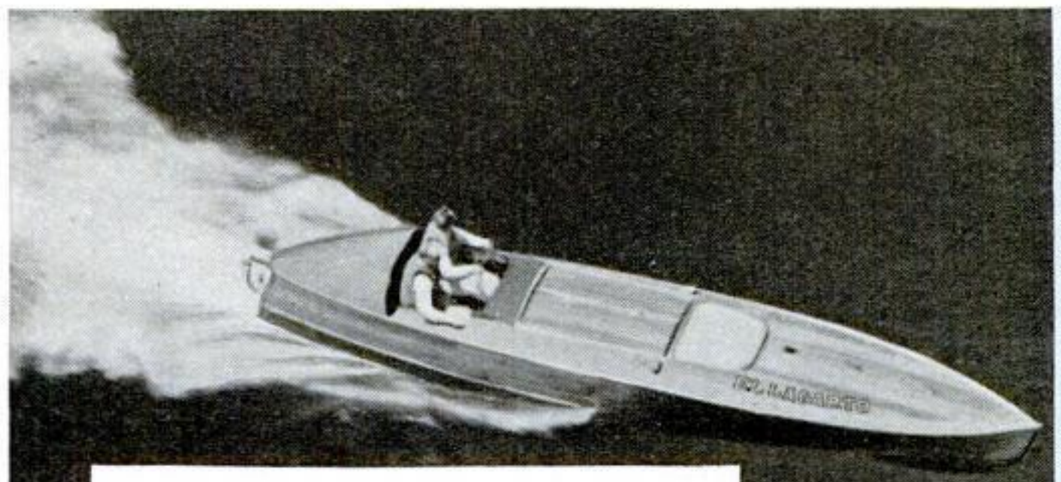


When the mainsail boom swings across the deck, the dog and detent are drawn back. This releases the crank disk, which makes a single half turn and braces around all the yards on the foremast

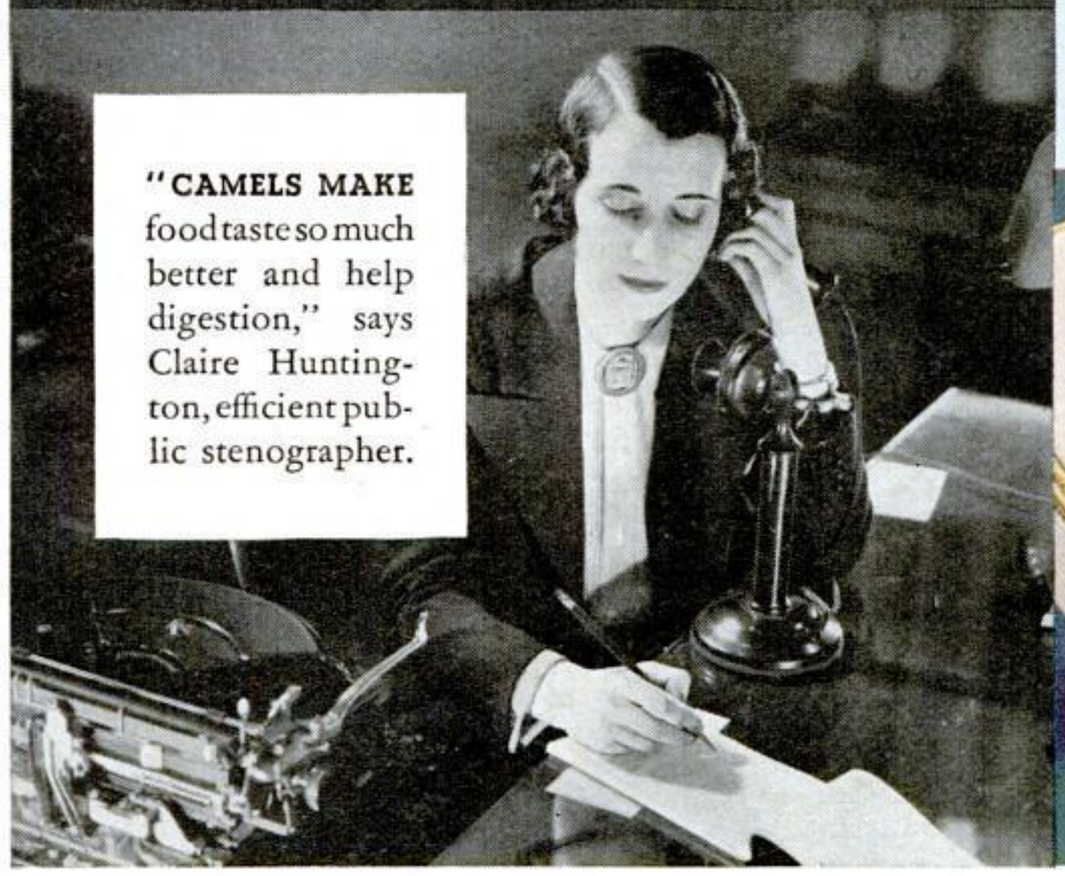
VICTOR HUGO RESTAURANT in Beverly Hills. As the guests pause between courses to enjoy Camels, Hugo himself nods approval. "Our guests have made Camels the favorite here," he says.

MRS. WILLIAM HOLLINGSWORTH, JR., of Los Angeles, says: "Camels stimulate my taste, aid digestion."

—for Digestion's Sake — Smoke Camels



GOLD-CUP WINNER! George Reis wound up *El Lagarto* to over 55 m. p. h. to win the Gold Cup three times. He says: "I eat heartily, smoke Camels, and enjoy good digestion."



"CAMELS MAKE food taste so much better and help digestion," says Claire Huntington, efficient public stenographer.

Camels stimulate digestion in a pleasant, natural way... increase alkalinity

The human digestion responds unfavorably to nervousness, hurry, and strain. It is definitely *encouraged* by smoking Camels.

Scientific studies show clearly the manner in which Camels aid digestion. Using sensitive scientific apparatus, it is possible to measure accurately the increase in digestive fluids—alkaline digestive fluids—that follows the enjoyment of Camel's costlier tobaccos. This has now been done repeatedly. The same studies demonstrate that an abundant flow of digestive fluids is important also to the *enjoyment* of food.

Make Camel your cigarette. Experience the welcome sense of well-being they bring you. For a cheery "lift" and for digestion's sake, enjoy Camels. They never get on your nerves. They are gentle on your throat.

COSTLIER TOBACCOS!

Camels are made from finer, MORE EXPENSIVE TOBACCOS—Turkish and Domestic—than any other popular brand.

Photoflash Synchronizer

ADDED TO ORDINARY SNAPSHOT CAMERA

By Ronald L. Ives

OPERATING SHUTTER SETS OFF FLASH

The camera and synchronizing attachment are held as shown at the right. When not needed, the battery case, socket, and reflector are removed by loosening a single screw that fits the tripod socket. Below is an enlarged view of the clamp for connecting cord to switch

ALMOST every amateur photographer tries, at one time or another, to take flash-light pictures. While the familiar method of opening the shutter with one hand, flashing the bulb with the other, and then closing the shutter works quite well with posed pictures, it is a trifle too slow for most purposes. Attempts at speed work by this method generally result in failure.

Owners of expensive cameras have available a number of satisfactory commercial synchronizers, which will work as fast as 1/200 second. Those who have less expensive cameras, with simple shutters, find synchronization a problem, because the commercial synchronizers are made for the so-called "set" shutters and also often cost more than the camera itself. With a little ingenuity, the owner of any one of the popular inexpensive cameras can make a synchronizer for flash bulbs that will work at "bulb" or 1/25 second.

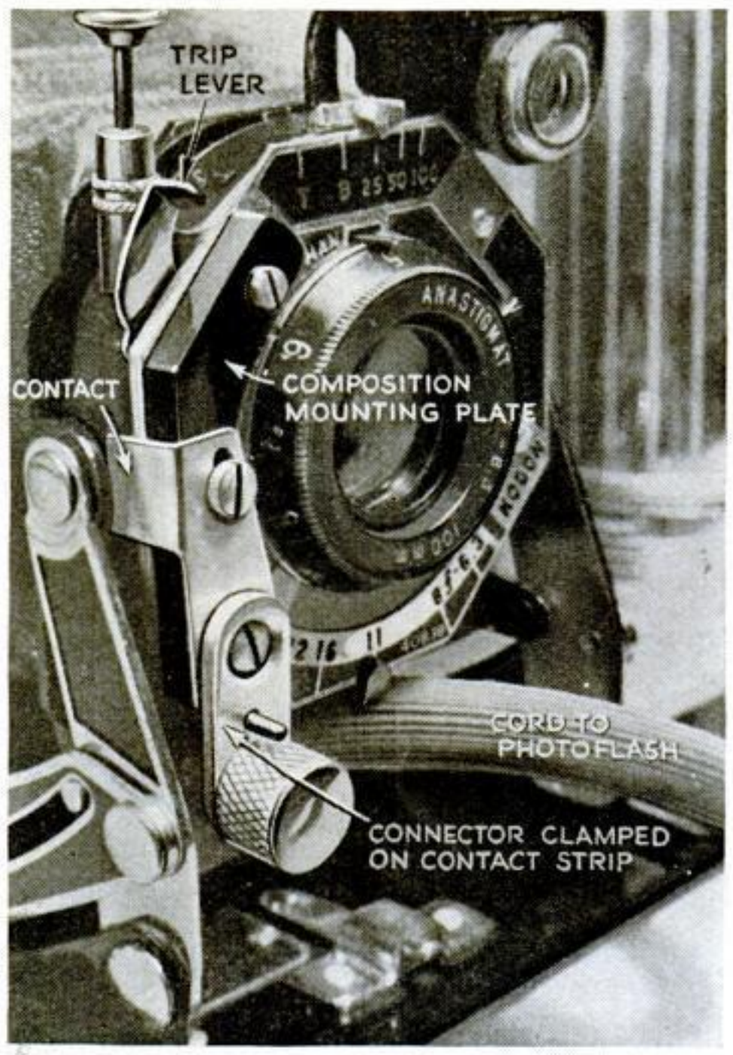
Simple shutters are so designed that they operate by the motion of a lever, which does both the setting and releasing of the internal mechanism. A contact, so arranged that the circuit is completed just as the shutter opens, is the basis of this synchronizer.

The contact may be made a part of the cable-release mechanism, or it may be made an integral part of the shutter mechanism. The space available between the shutter shell and the frame of the camera is small, being about 1/16 in. A space of about ½ by 1½ by 3/16 in. on the front of the shutter, adjacent to the trip lever, may also be utilized.

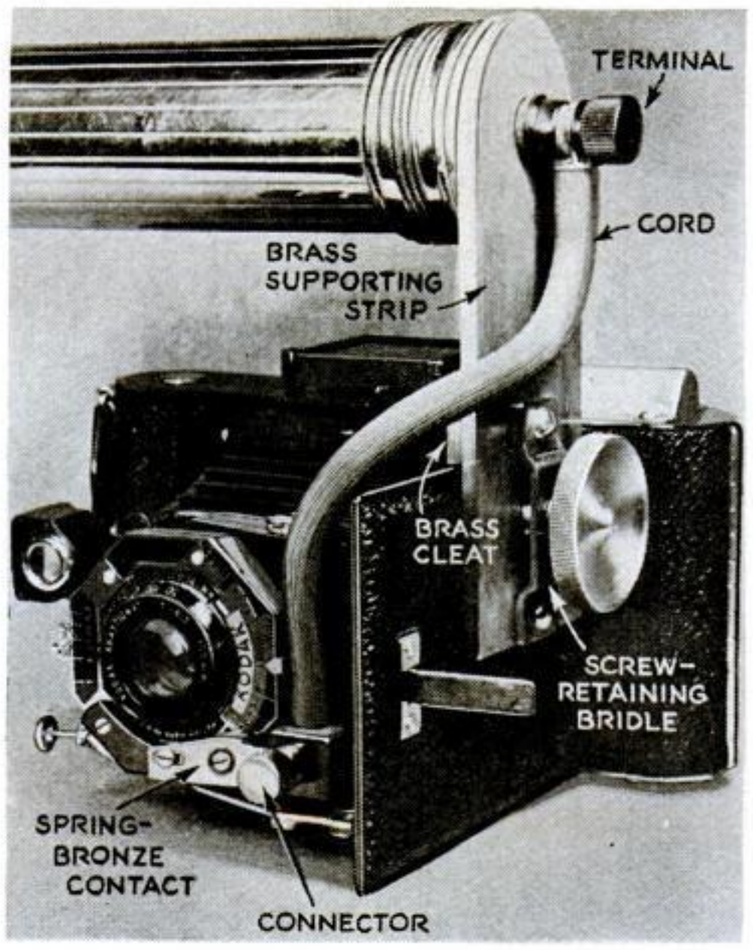
A plate of some hard insulating composition is fitted to the front of the shutter plate and provides a mounting and insulator for the flash contact. The composition must be cut so that it does not interfere with the rotation of the front lens, or extend so far downward that it interferes with closing the camera. This plate may be attached to the shutter plate without drilling any new holes in the shutter. Simply drill mounting holes in the composition to correspond with the screws in the shutter front plate, and use new screws through these holes. (Most shutter screws have the so-called "Elgin" thread.) The screw heads that are to be covered later by the contact strip should be deeply countersunk so they will not touch the contact strip.

The contact strip is made of thin spring phosphor bronze, cut to an L-shape, with the arms of the L about ¼ in. wide. One arm should be about 1½ in. long, the other ¾ in., the exact dimensions depending on the particular camera and shutter. The short arm should be bent at right angles, so that when the long arm is placed on the composition strip, the bent shorter arm will project through the gap between the shutter shell and the camera frame, as illustrated.

Two slotted holes are cut in the contact strip, and the strip is placed on the composition plate. Set the shutter at "B" and push the trip lever down very slowly until the shutter just opens. Put the top of the contact strip in contact with the trip lever, move the strip laterally until it touches neither the shutter shell nor the camera frame, and *(Continued on page 87)*

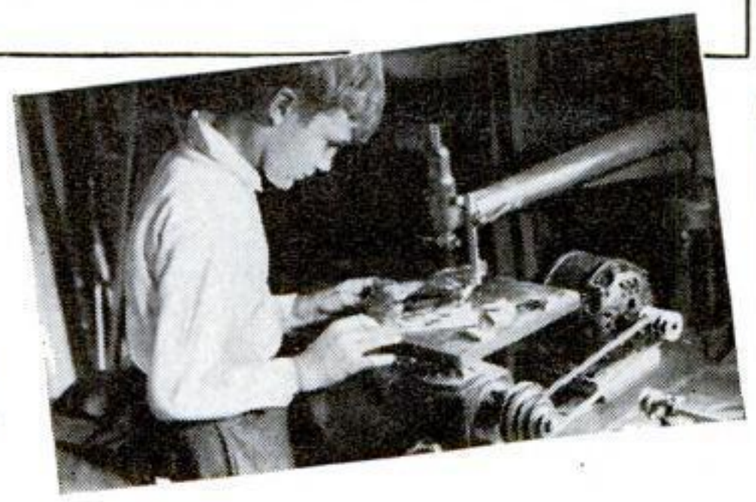


The synchronizer in place on a popular type of folding camera. When the shutter trip lever moves down, it strikes the spring contact and closes the battery circuit, thus setting off the flash at the instant the shutter is wide open. The method of attaching the battery case is shown in the bottom view at the right



FAST ACTION

INDOORS AT NIGHT



EVEN IN THE RAIN

Much less than actual size

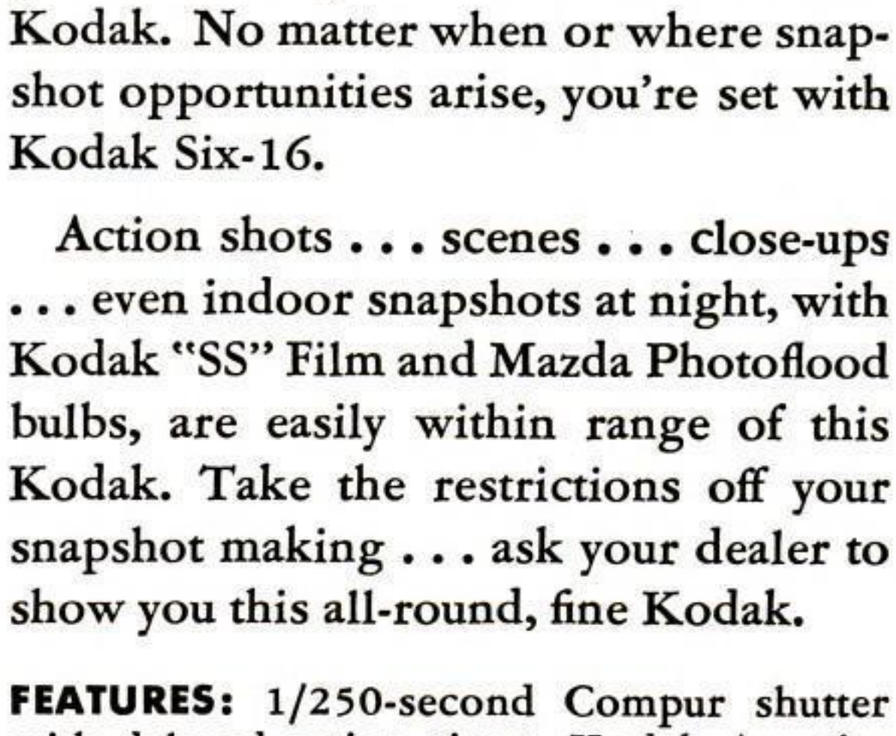
For the pictures you want —*when you want them*

THE big fun of picture making is in having a camera that doesn't need time off. Kodak Six-16 (*f*.4.5) lets you master every snapshot opportunity.

Every hour of the day or night is picture-making time with this modern Kodak. No matter when or where snapshot opportunities arise, you're set with Kodak Six-16.

Action shots . . . scenes . . . close-ups . . . even indoor snapshots at night, with Kodak "SS" Film and Mazda Photoflood bulbs, are easily within range of this Kodak. Take the restrictions off your snapshot making . . . ask your dealer to show you this all-round, fine Kodak.

FEATURES: 1/250-second Compur shutter with delayed-action timer, Kodak Anastigmat *f*.4.5 lens, eye-level finder. Makes 2½ x 4¼-inch pictures, costs $40.



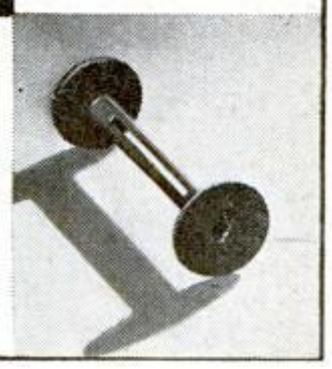
KODAK AUTO-FOCUS ENLARGER, MODEL B—The ideal enlarger for home darkroom—takes negatives up to 4 x 6 inches, is adaptable to film or plate negatives, enlarges from 1½ to 3½ diameters. Complete with lens, Photoflood lamp, paper holder, table clamp and set of seven flexible metal masks. Price, $40.

The 4-section lens is a photographic jewel . . . a high-quality, high-speed anastigmat that "makes good" under difficult conditions.

The Compur shutter has eight speeds, from 1 to 1/250 second. Has delayed-action timer so that you can get in the picture yourself.

The eye-level finder frames the picture accurately when following fast action. When not in use it folds flat against side of camera.

Metal spools make the Kodak Six-16 the smallest roll-film camera for its picture size. No bulky wooden spools to take up valuable room.



NEW KODAK CATALOG

Just off the press—1936 edition of the small Kodak catalog. Write today for your copy, or get it at your dealer's . . . Eastman Kodak Company, Rochester, N. Y.

Name_____

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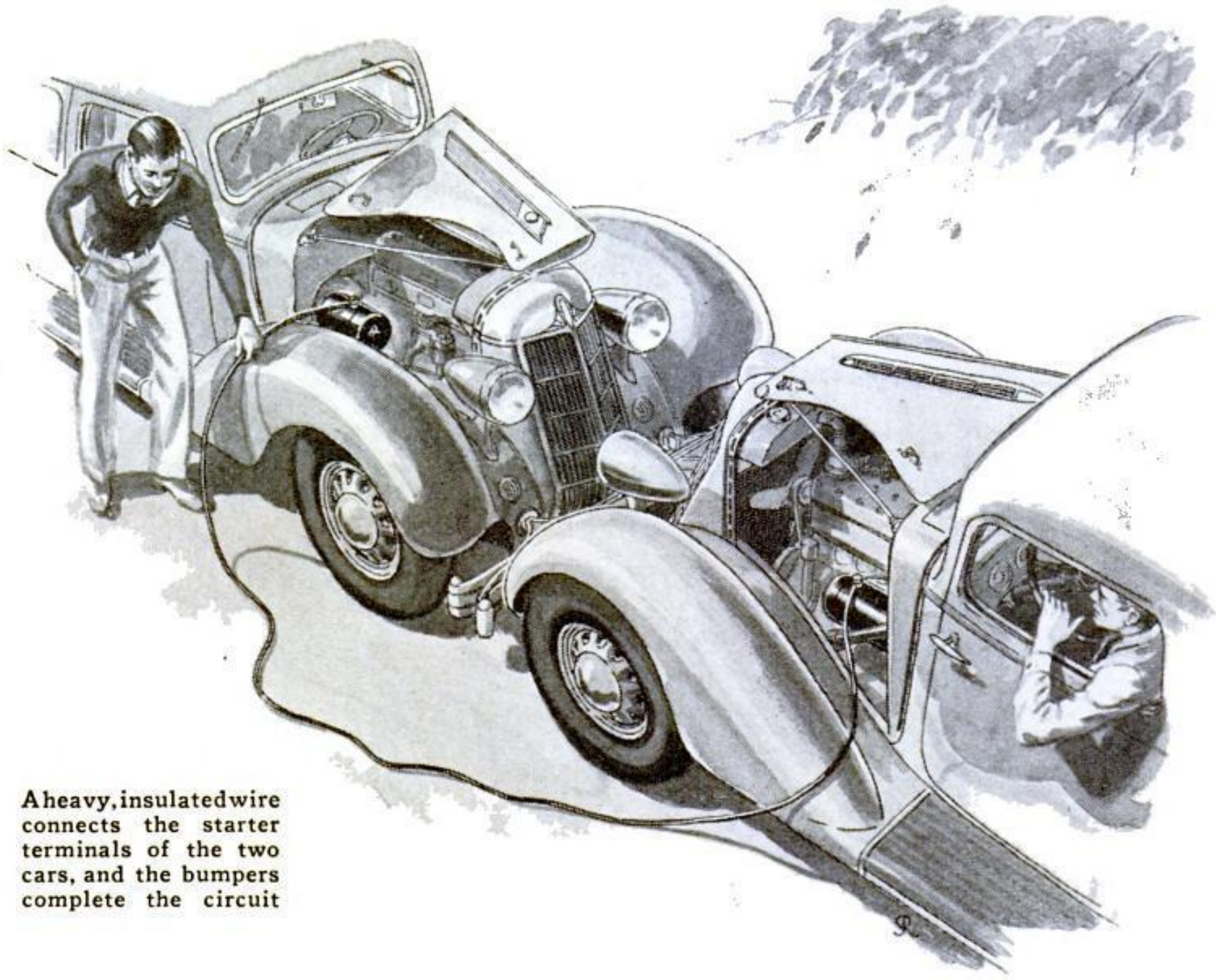
P. S. 8-36

Short Cuts *for* Car Owners

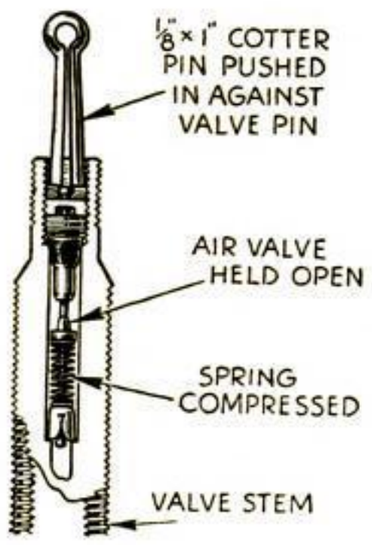
Using Borrowed Current To Start Your Car

A CAR with a dead battery generally can be started easily by making use of the simple kink illustrated. The contact at the bumpers provides a mutual grounding connection, while the heavy, insulated wire connecting the two starter terminals completes the circuit. Whether it will be necessary to push one or both starter pedals to close the circuit will depend on the electrical hook-ups in the cars. As soon as the motor of the stalled car starts, the hook-up wire should be immediately jerked loose to break the connection between the two cars.—M. J. H.



A heavy, insulated wire connects the starter terminals of the two cars, and the bumpers complete the circuit

Cotter-Pin Opens Valve



Spreading legs of a cotter pin hold the air valve wide open

INSTEAD of removing the valve the next time you want to deflate an inner tube, just spread the legs of a one eighth by one-inch cotter pin slightly and push it into the valve stem. The ends of the prongs will push down the valve, while their springiness will hold the cotter pin in place.—D. S.

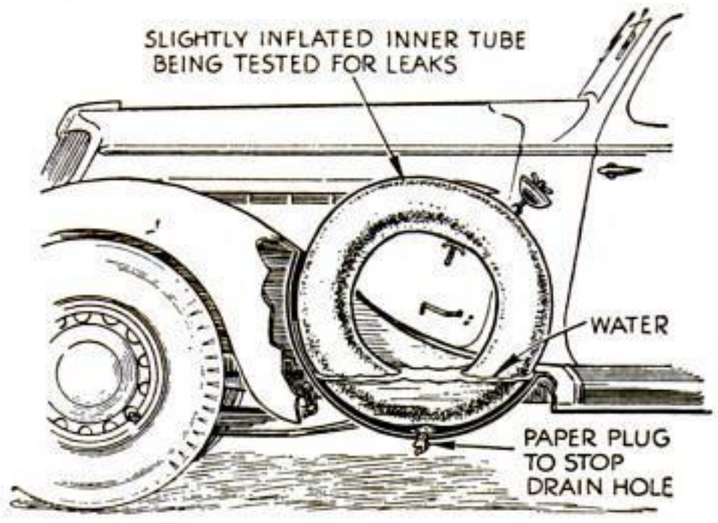
Protects New Radiators

NEW radiators can be protected from corrosion with a homemade solution of potassium chromate and distilled water—two teaspoonfuls of the chemical to five and one half gallons of water. When the radiator has been filled, boil the solution for a minute or so by holding a newspaper in front of the radiator while the motor is running.—E. F. S.

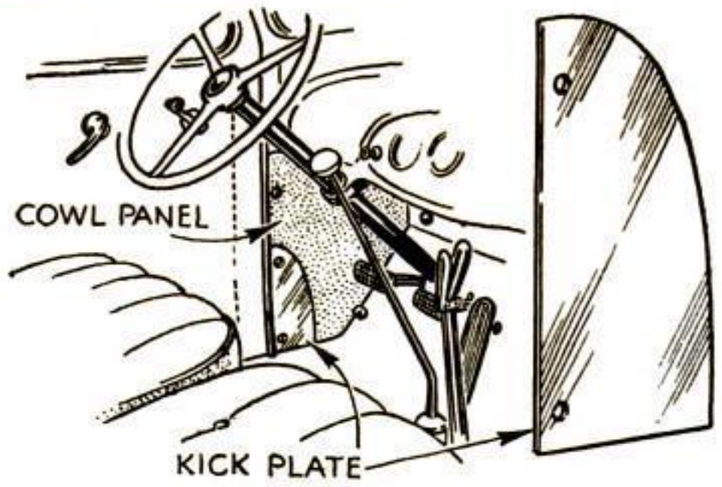
A solution of potassium chromate in distilled water guards new radiators against corrosion

Emergency Water Trough for Tube Testing

IN AN emergency, a spare-tire fender well can be used as a handy water trough for testing leaky inner tubes. Simply plug the drain hole in the bottom of the well with a wad of cloth or paper and fill with water. The partially inflated tube then can be submerged as shown at the right and rotated slowly until air bubbles appear to indicate the leak. If no water is available where the inner-tube repair job is being done, enough for the test can be drained from the radiator without greatly impairing the efficiency of the cooling system—at least, until the withdrawn water can be replaced.—E. N.



Spare-tire fender well filled with water for use in testing a leaky tube. Drain hole is plugged

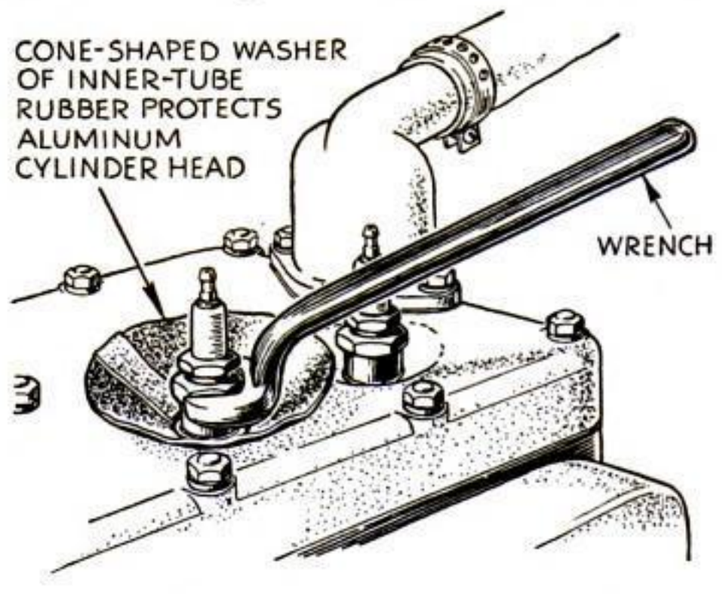


Metal Kick Plates For Cowl Panels

AFTER several years of continual scuffing and kicking, the forward edges of the cowl panels on most small cars are badly worn. To cover up the worn spots and prevent any further wear, I recently installed a metal plate at the lower front corner of each panel on my car. I cut the "scuffers" from sheet aluminum and fastened them in place with the same screws that hold the paneling. If desired, sheet fiber covered with leather could be used in place of the metal.—D. J.

Cylinder-Head Guard

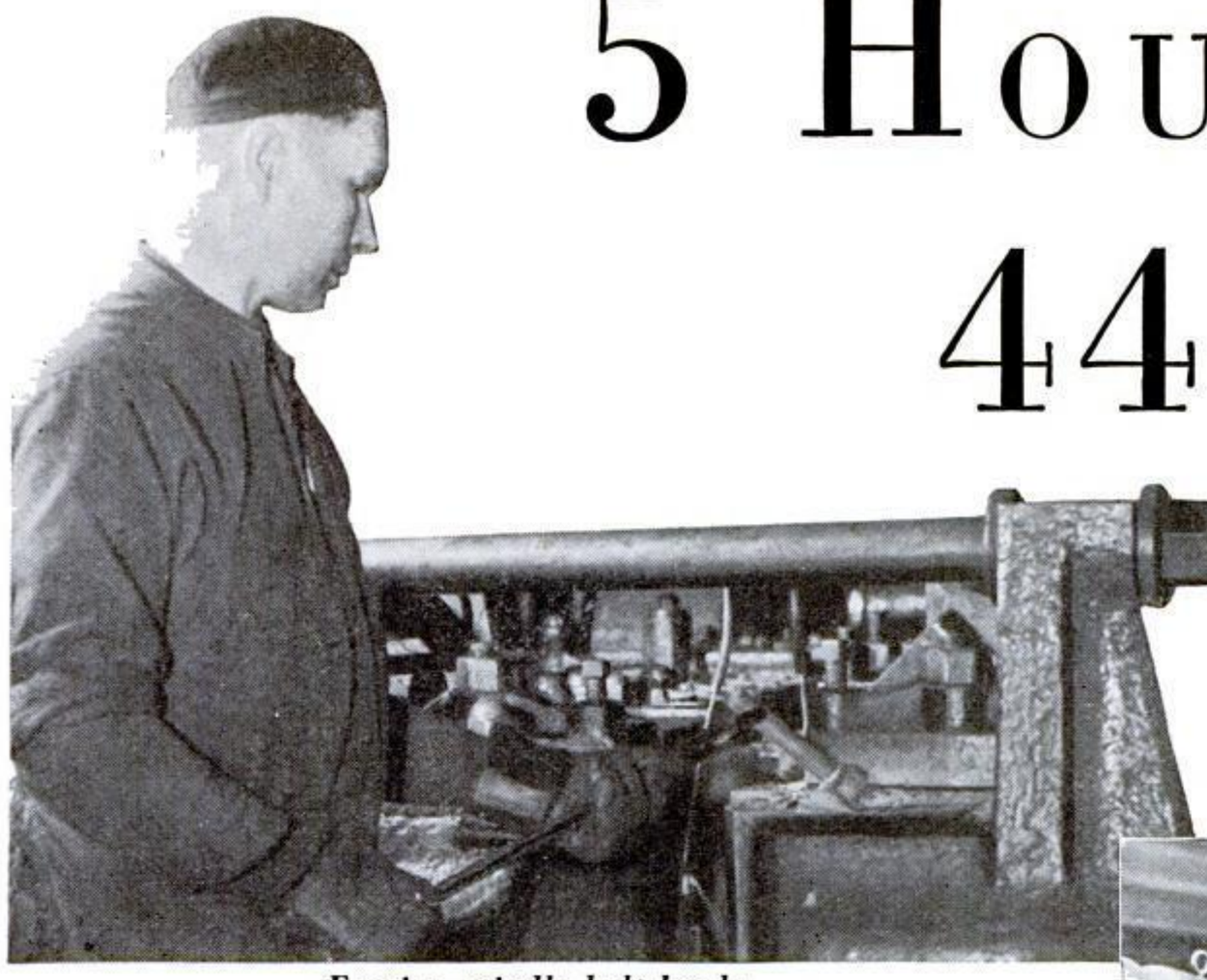
WHEN removing or replacing spark plugs on a car fitted with an aluminum cylinder head, it is difficult to prevent the wrench from digging into the soft metal. To protect the cylinder head on my car, I cut a large rubber washer from a piece of inner tubing to fit the recess.—E. E. S.



This simple trick protects soft aluminum cylinder heads from being scratched by the wrench

5 HOURS *and* 44 MINUTES

TO MAKE ONE FORD SPINDLE BOLT!

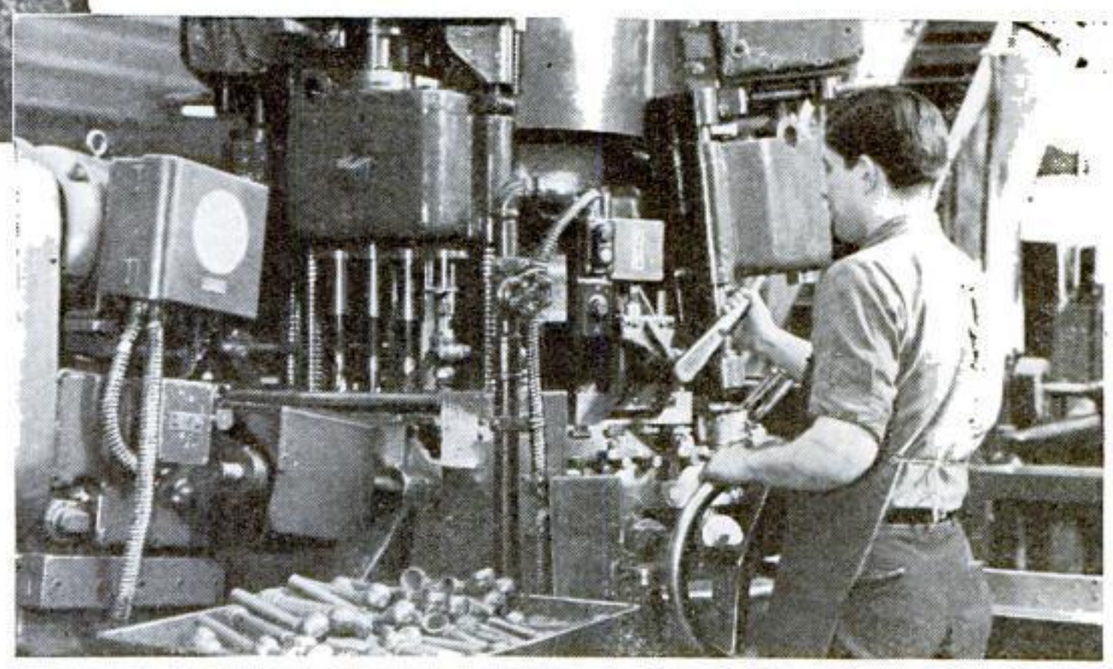


Forging spindle bolt heads.

FOLLOW a Ford spindle bolt through the various operations of its manufacture and you will spend the better part of a full working day. From the time a piece of rough stock is sheared from a bar until the finished spindle bolt is produced, you will see 33 different operations that will take 5 hours and 44 minutes to complete. You will be impressed by the care and precision used in the various forging, machining, grinding and inspection operations.

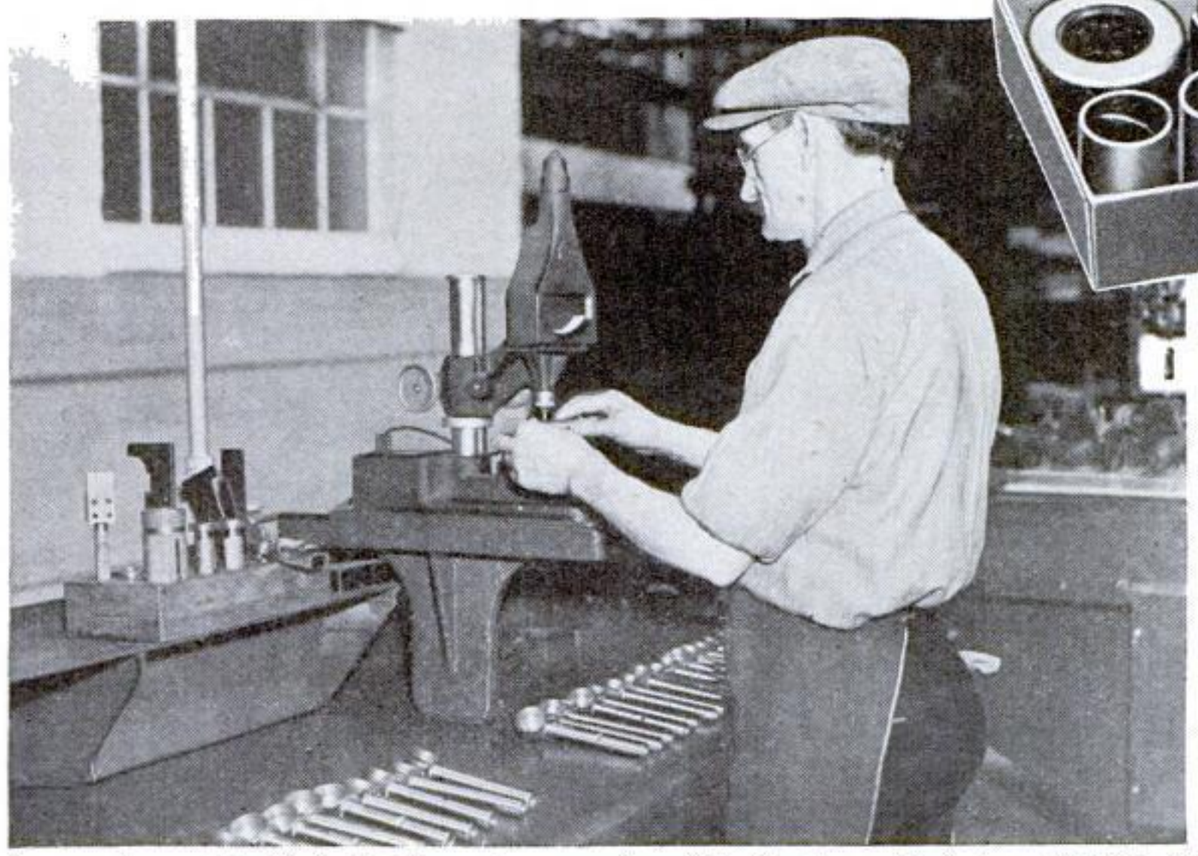
And when that spindle bolt is finished it will be the best spindle bolt that men, money, machines and experience can make.

The care taken and the precision used in the manufacture of Ford spindle bolts are typical of that used in the making of all Genuine Ford Parts. Quality materials, expert workmanship, precision machines, careful inspections are important in the making of a vital part such as the spindle upon which your safety depends — it pays to demand Genuine Ford Parts!



This huge, semi-automatic machine with rotating table performs six machining operations simultaneously.

When replacement parts are needed, you can maintain with Genuine Ford Parts the same high standards of quality and performance that were built into your Ford car or Ford truck at the factory.



Inspecting spindle bolt diameter on visual indicator which has 1000 to 1 magnification—1/1000 inch looks like 1 inch on the scale.

Ford Spindle Bolt and Bushing Kits contain all necessary parts for completely rebushing the spindles. Included are spindle bolts, bushings, thrust bearings, locking pins, nuts, felt washers and retainers. The complete kit costs less than when the parts are purchased separately.

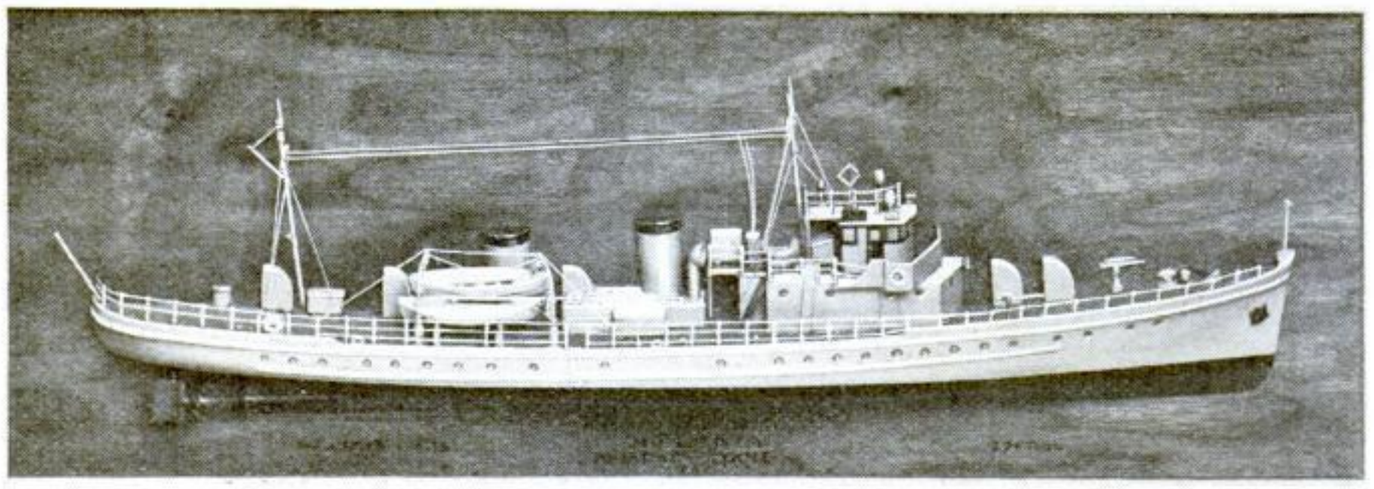
GENUINE Ford PARTS

Heat-treated spindle bolt forgings from continuous type electric furnace.

FORD MOTOR COMPANY, DEARBORN, MICHIGAN

Capt. E. Armitage McCann *tells how to complete our*

Coast Guard Patrol Boat



Half model of Coast Guard boat *Atlanta* with 20⅝-in. hull mounted on a panel for hanging on the wall. The model is equally decorative when made with a full hull in the usual way

I HAVE transferred my allegiance from destroyers to the new 165-ft. U.S. Coast Guard patrol boats. Smart they have to be, not only in looks, but also in fact, because their rescue work is usually done when the elements are at their worst. There are no finer power-driven craft than these Diesel-engined patrols.

Working drawings for building a model of one of the boats, the *Atlanta,* were published last month (P. S. M., July '36, p. 55), and the hull and some of the deck fittings were described in detail. We now continue the instructions.

Alongside the casings on the starboard side is a rack for six fire extinguishers, a life-belt box, and two collision mats; on the port side, a life-belt box only. Anything in the nature of a box that stands on deck should have battens under it.

There are four other companion hatches, rounded on the foresides and with iron doors abaft. The aftermost but one is double width, with two doors.

Abaft the funnels stands the vegetable locker, with ventilating slots indicated. At the foreside of the mast are the boat-gear boxes, and abaft is an oval access trunk, which is also the towing bitt. There is another access (or escape) trunk for the engine room abaft the deck house.

The masts should not be more than 3/32 in. in diameter at the deck, so make them as thin as you can. A good idea is to make them of tapered brass rod. Above them extend the flagpoles set in iron caps; they can be tied on with wire or thread. There should be an all-round lantern at the head of each mast, two shining forward on the foremast and one shining aft on the aftermast. Glass beads will do for these, the masthead ones going on pin points and the others being wired on. The aftermast also has an ensign gaff.

The antenna yards are also slender and should be rod or wire. To them are soldered four thin wires of such a length that they will be tight when the yards are in position. To accomplish this, fasten them down on a piece of board the right distance apart and then solder on the wires. They hang from the mastheads with halyards and have guys from the ends to backstays. The knobs on their gear are insulators.

The foremast has two lower and two topmast stays leading to bolts in the upper deck, and lower backstays each side leading to bolts on the bridge deck. The aftermast has one stay and two backstays either side. All stays are tightened by turnbuckles, but they would be only ⅛ in. long on the model.

There is a wire from each of the antenna wires leading vertically into the lead-ins. Signal halyards hang with small blocks from the stretchers and belay to cleats on the mast.

The flagpoles have lanterns at their ends and the usual halyards.

The anchors can be cast or cut from lead or other material. They are the usual Navy pattern. The chains, with about fourteen links to the inch, lead up the hawse pipes, over the windlass, and down the chain pipes.

The windlass is shown in detail on the blueprint drawings published on page 57 last month and can be made entirely from wood or metal. The centerpiece represents the Samson post and gearing; next are the wildcats, which are recessed and toothed to grip the cables when hoisting the anchor; then the bearings and drums for heaving on lines; and abaft is the motor. Abaft and under the wildcats, bore holes for the chain pipes to the chain locker.

Both the three-inch and the one-pounder guns can easily be represented with two pieces of brass rod soldered together, and with others filed to shape for the stands, or the stands can be made from wood. I constructed brass guns on wooden mounts.

THE plans call for two 19-ft. surfboats on one side and two 19-ft. dories on the other but, in practice, the patrols seem to carry the dories in the davits and the surfboats on the skids. I hollowed out the dories and gave them thwarts and oars, and put fine calico covers on the surfboats.

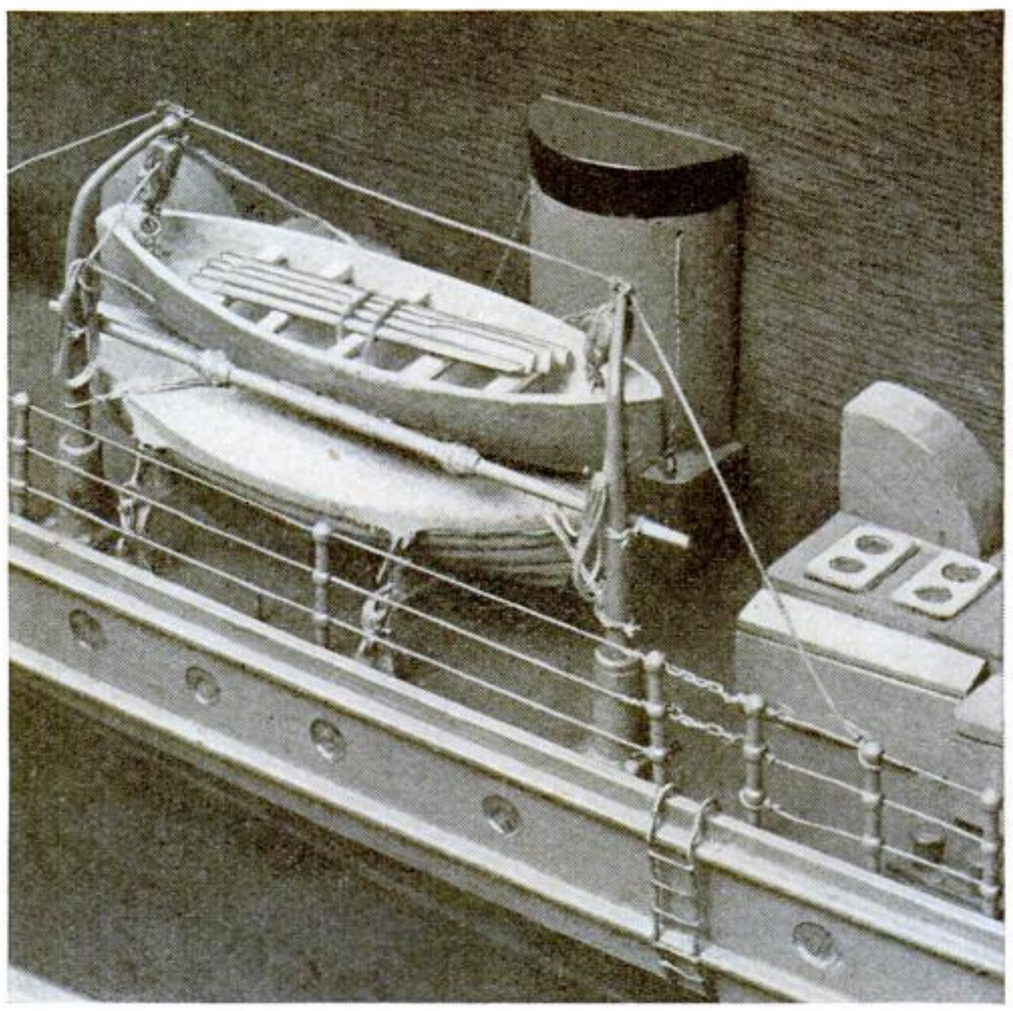
The davits stand in long deck sockets and are rather more sharply bent than is customary. They should have the usual two double-block falls and guys to bolts in the deck. The hanging boats will be steadied against the strongbacks, stretched between the davits, with rope gripes. When the boats are swung inboard, these gripes will lead to their opposite davits, above the lower boats; but when the boats are swung outboard, they will lead to bolts in the deck.

The skids are of T-iron bolted to the deck. I merely used flat metal flared at the ends, bent to shape, and stuck in the deck, with a small eye soldered to each side of each for the gripe lashings. The latter I made as shown in a detail drawing, thus holding the boat down, and then glued wedge-shaped pieces in position for the chocks (cradles).

Other details are the cut or cast mooring bitts and the mooring lead chocks, which are pieces of metal cut to shape and stuck in the deck. There are several gooseneck vents and standpipe oil fillers made of bent No. 18 wire. On the afterdeck are two deck lights, and at the rail two more life buoys.

All around the deck are handrails with stanchions. These are all the same height of ½ in. from the deck, but as the bulwark height varies, the number of rails are not the same throughout. At the forward section one-ball stanchions are used, along the waist three-ball, and aft two-ball, although here I used three-ball but with no wire in the lower holes. Forward I bent them to lie close to the bulwark and made them upright above the bulwark. Through the stanchion holes are threaded No. 34 wire or thread. At the gangways (side ladders) I used pieces of bead chain.

The flags, when the boat is under way, are the Coast Guard flag at the fore, and the ensign at the gaff; when at anchor, the ensign is shifted to the staff, and the jack is hoisted forward.



Dory in davits with surfboat below on skids, and other details. To save expense of buying stanchions, pins or nails may be used

BROOM-STRAW RATLINES EASILY MADE

ON SIMPLIFIED ship models, broom straws may be used for ratlines. Cut them longer than needed, enamel them black, and set in place while still sticky. They will adhere firmly to the shrouds and may be trimmed when dry. Lightly varnished straws may also be used for capstan bars and other parts that support no weight. —J. H.

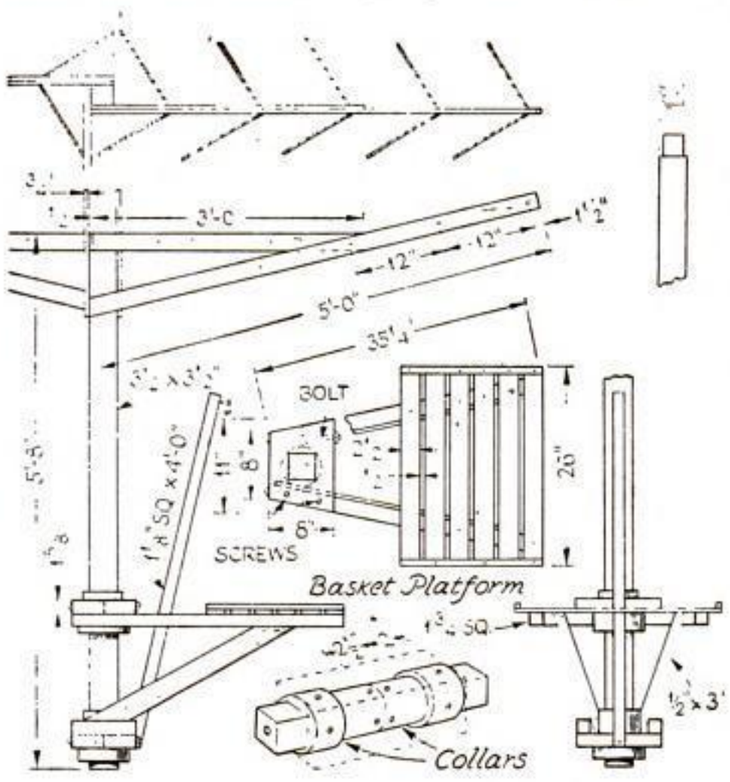
OUTDOOR CLOTHES DRIER HAS BASKET PLATFORM

As the lines become filled, the platform with the clothes basket is pushed around the post

THE task of hanging up clothes on a laundry clothes tree or outdoor drier can be made considerably easier by constructing a simple revolving table and bracket for the basket and clothespin bag. The table, with a slight push, turns around the clothes post as the line above becomes filled, and not much bending has to be done. This results in saving a good deal of time and energy.

To construct the collars upon which the platform revolves, take a block about 1 ft. long with the same cross section as the post to serve as a form. Center this piece in a lathe. Fasten a block of hardwood to each side, placing the screws near each end and countersinking them deeply. Then turn the whole to the shape shown in the small perspective sketch. Set two more countersunk screws in each side near the center, and cut the piece into two collars of equal size.

Remove the eight pieces from the square stock and fasten them to the clothes-tree post to form the two bearings upon which the table



How the drier, basket platform, and bearing collars are made. Note clothespin-bag hook

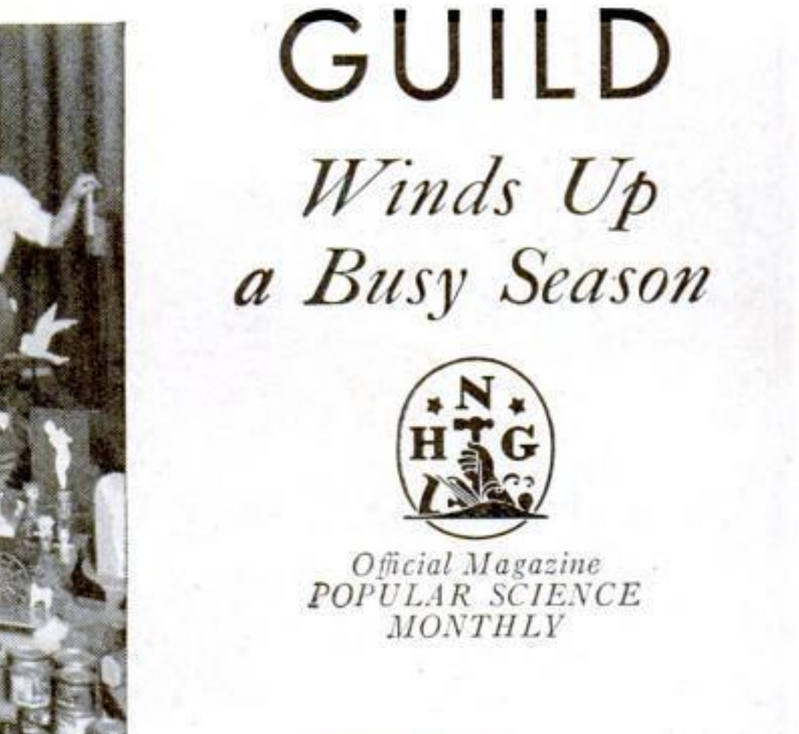
supports revolve. Blocks with a round hole of the same diameter are then made and bolted around these bearings. To these blocks the table is attached as shown. The remainder of the work can be done by following the drawings.—D. R. TOMPKINS.

NATIONAL HOMEWORKSHOP GUILD

Winds Up a Busy Season

Official Magazine
POPULAR SCIENCE MONTHLY

Display of work by Newcastle (Calif.) Club, and some of its members. *In circle:* C. H. Russell and (right) P. F. Hirsch



EXHIBITIONS, dinners, outings, and other events brought to an end a successful and busy season for the majority of the clubs in the National Homeworkshop Guild. A few of the clubs are continuing their regular meetings through the summer. Others are planning to hold picnics or occasional get-togethers, but a large number have recessed until September.

Despite the advance of summer, twenty-six clubs have been organized and have applied for charters in addition to the twenty-seven listed last month. The organization of so many clubs in such a short time breaks all records since the Guild was founded in 1933.

To date the Guild has granted 245 charters to home workshop clubs in 44 states, Canada, and Puerto Rico. A further large increase is expected in the fall because the Guild is now in so strong a position that it does not have to ask the affiliated clubs to contribute any dues. The Guild is one of the few national organizations in which membership is free.

Shenango Valley Homeworkshop Club, Sharon, Pa. The second annual exhibition of handicraft was held in the Sunshine Home recently. Women of the valley were invited to submit needlework, but not for competition. There was a small admission fee, and the proceeds will be used to purchase material with which to make toys. These will be distributed to unfortunate children at Christmas. Ribbons were awarded as follows: Furniture—first, M. J. Martin, bookcase; second, Gustave Englund, footstool; third, M. J. Martin, table; honorable mention, R. C. Martz, coffee table. Woodturning—first, Mike Bebech, ash tray; second, T. A. Davison, end table; third, Richard Murphy, pipe rack; honorable mention, Mike Bebech, candlesticks. Novelties—first, Gustave Englund, table lamp; second, Lester H. Newell, long bow; third, Gustave Englund, sewing cabinet; honorable mention, Lester H. Newell, toy furniture. Model making—first, Roy Marx, coach. Decorative metal—first, Charles Fornander, copper vases; second, Charles Fornander, candlesticks; third, Charles Fornander, Italian wine jug.

Exhibition of craftwork by the St. Louis (Mo.) Homeworkshop Club

Decorated metal—first, M. J. Martin, lamp; second, Gustave Englund, floor lamp; third, R. T. E. Bowler, ship lantern; honorable mention, R. T. E. Bowler, desk set. Homemade tools—Lester H. Newell, electric spot welder. Charles Fornander's hammered copper vases were judged the most outstanding work, and he has been awarded the POPULAR SCIENCE MONTHLY sterling silver medal. Victor Kosa had made a 16-ft. inboard motor boat, but it was too large to get into the exhibition hall.

Jacksonville (Fla.) Homeworkshop Club. The complete shop of the late Dr. Herrman H. Harris, consisting of all types of woodworking tools and some special tools developed for working cold wrought iron, was willed to the Eastman Georgia High School as a memorial. "Dr. Harris was well known and liked in Jacksonville," writes H. Van Buskirk, the club secretary. "He was a heart specialist and considered one of the best in the southeast states. He had a keen interest in boys and was an ardent hobbyist and a clever workman. Somewhat handicapped by a heart ailment himself, he devised numerous means of achieving a desired result with the minimum of physical effort. He had the most complete home workshop in Florida."

Lambert's Homecraft Boat & Mariners Ass'n., Chicago, Ill. This neighborhood boat builders' club was organized recently and Alfred M. Majewski was elected president; Walter J. Majewski, vice president; Capt. Richard D. Lambert, secretary; Zigmunt Majewski, treasurer. Each member has pledged to help supply material and use his spare time in building model boats and toys, which will be given to the shut-in children of a county hospital.

Blanton Homeworkshop Guild, Lake Park, Ga. Officers of this new club are S. H. Carter, president; C. F. Seckinger, vice president; V. E. Dennis, secretary and treasurer.

Brockton (Mass.) Homecraft Club. Since the club was started in March, the members have constructed a pipe rack, radio cabinet, wall plaque, and a metal picture stand. The interests of the group vary, including woodwork, leather work, metal work, and amateur radio. At present two members are constructing a short wave receiver.

Capital Homecraft Club, Washington, D. C. "The History and Romance of the Art of Bookbinding" was discussed by George A. Simonds at a recent meeting. J. Chlopicki also spoke.

St. Louis (Mo.) Homeworkshop Club. A very active winter season has just been completed. There were demonstrations on wood turning, tool sharpening, and the circle saw by J. Murphy, high school instructor and honorary member, and demonstrations of silver soldering and metal hammering by C. Collins. Clubrooms have been acquired and are being equipped with a complete workshop. Fifty-one projects were displayed in an exhibition held in conjunction with the 41st Annual Convention of the American Physical Education Association at the Hotel Statler.

East Side's Homeworkshop Guild, New York City. Morris Kreiss is president; Sol Sobel, vice president; Emanuel Pollack, secretary; Nathan Kesselsmidt, treasurer.

Club des Artisans Amateurs, Trois Riviéres, P. Q., Canada. New officers are as follows: S. O. Balleux, president; Maurice Richard, vice president; J. Henri Dube, secretary-treasurer; Albert Ricard, librarian. The board of governors is composed of Donat Belanger, W. Jaques, and Edmond Boisvert. Mr. Ricard exhibited a miniature cathedral at a recent meeting.

Berkshire Homeworkshop Club, North Adams, Mass. A model of the *Great Republic,* made by Everett Barton, secretary, from plans published in POPULAR SCIENCE MONTHLY, was shown in a local hardware store and at a 4-H exhibit *(Continued on page 82)*

NATIONAL HOMEWORKSHOP GUILD CLUBS

(Continued from page 81)

in order to interest people in the club. Three sets of candlesticks, turned on a lathe by Beryl Barton, were also displayed.

The K. Y. Homeworkshop Club, Roxbury, Mass. Jordan Kadetsky is president; Eli Fox, vice president; Julius Robinson, secretary; Herbert Barron, treasurer. There are nineteen charter members.

Mount Vernon (N.Y.) Homecrafters. John Stevenson was presented with an 8-lb. gavel for winning a contest on novel ideas. Willard Cunningham received a paper napkin holder as second prize. A new 24-in. jig saw, donated by the Recreation Commission, has been installed at club headquarters. Plans have been completed for a joint meeting with the Peekskill (N.Y.) Homecrafters. The members have decided to continue activities through the summer instead of suspending them as heretofore.

Minneapolis (Minn.) Homeworkshop Club. All the members of this club belong to the Minneapolis Model Club, which recently had an exhibition at a local hardware store. Believing, however, that there were more prospective members interested in other phases of woodworking and similar crafts, the group was changed to a home workshop club. Ray Jensen is president; Byron Pierson, vice president; L. E. Burgan, secretary-treasurer.

Lamesa (Tex.) Homeworkshop Club. L. P. Stark has been elected president of this new club; Hardin Easterwood, vice president; R. A. Stuart, secretary; Edwin Easterwood, treasurer; Carlton Lee Tune, librarian.

Cartier Homeworkshop Club, Montreal, Canada. Organized recently, the club plans an active summer season with monthly meetings. Charles Patenande is president and Paul Denis, secretary.

Santa Monica (Calif.) Homeworkshop Club. Dr. Frank C. Clark was elected president at the organization meeting held at his home. O. H. Uvaas was named vice president and Donald Howland, secretary-treasurer. Dr. Clark demonstrated wood carving and Mr. Uvaas band-saw cutting. There are sixteen charter members.

Brookhaven Homeworkshop Club, Chester, Pa. The following chairmen have been appointed: Michael Gardner, tools and machinery; George T. Whiteley, Sr., projects. Francis Jackson was named club photographer and Mrs. Amie Whiteley, club librarian. George T. Whiteley, Jr., displayed a clipper ship he had made.

Lowell (Mass.) Homeworkshop Club. The members have decided to construct a motor boat to be powered with an automobile engine as their first project. It will be about 18 ft. long.

The Hobby Guild, New York City. Julius Singer is president; Morris R. Schenker, vice president; Charles Lorber, secretary; Murry Singer, treasurer.

Patchogue (N.Y.) Model and Hobby Club. Officers for this year are William A. Rogers, president; John H. Murray, vice president; Cyrus Ayer, secretary and treasurer; Winslow Eckert, instructor.

Cedar Rapids (Iowa) Homecrafters Guild. R. L. Whelan is chairman; Dr. L. W. Butterfield, vice chairman; M. J. Prochaska, secretary; George T. McHardy, treasurer.

Czecho-Slovak Crafts Club, New York City. The purpose of the organization is "to stimulate interest in combining American and Czecho-Slovak crafts, and to introduce and popularize them."

Wichita (Kans.) Homecraft and Hobby Club. The following officers have been elected: M. H. Kerr, president; John F. Greider, vice president; J. B. Hurlock, secretary-treasurer; E. Sefton, librarian; Mildred Gholson, club reporter; and W. E. Laird, club photographer. Ten men and seven women attended the group's organization meeting which was held recently in the City Library, and there are now thirty charter members. Plans are being made for holding a local exhibition and a membership drive. Some of the occupations already represented in the club are clerk, dentist, optometrist, machinist, manual training instructor, jeweler, housewife, public stenographer, bank employee, draftsman, insurance salesman, museum caretaker, florist employee, newspaper employee, press foreman and artist. . . . Mr. Kerr, the president, has an unusual hobby of making handmade individualized desk sets for distinguished persons. He gained national attention with his hobby in February, 1934, when he sent an individualized clock to President Roosevelt, and he recently completed a desk clock of the same design for the Governor of Kansas.

Roseburg (Ore.) Homeworkshop Club. A display of craftwork by members was held in a local hardware store in June.

Nampa (Idaho) Homecraft Guild. E. L. Goodnight demonstrated a drill press at a recent meeting at the workshop of Glen Wright. William Talley displayed some specimens of various woods he had collected. A demonstration of woodturning was given by L. A. Wirth at S. G. Honstead's shop. Frank Hurt gave a talk on television and electricity.

Fall River (Mass.) Homecraft Club. A delegation from the New Bedford Woodcraft Club attended a meeting at the home of George Legault. Plans were made for an exhibition.

Lincoln (Neb.) Homeworkshop Club. The following officers have been elected: Charles E. Booth, president; J. J. Buck, vice president; J. L. Witmer, secretary-treasurer; Robert B. Dyer, librarian. The Board of Governors consists of Frank DuTiel, Albert Bietz, and H. W. Bradley.

Brunswick (Me.) Homeworkshop Club. The members visited the Bowdoin Mill at Topsham through the courtesy of the Pejepscot Paper Company. The program was arranged by Earl Small assisted by Benjamin Burbank and Hollis Walker.

Freeport (N.Y.) Craftsman's Guild. Two exhibits have been held this year, the first in connection with the Freeport Housing Exhibition and the second at the school where meetings are conducted. Officers have been elected as follows: J. K. Pitcher, president; H. Bingel, vice president; G. S. Flint, secretary-treasurer; W. W. Kellam, librarian. The board of governors consists of T. W. Congdon, J. B. Cook, and W. A. Parker.

Edmundston (N.B., Canada) Hobbyists Club. The first of a series of lectures on wood finishing was given recently by Martin Theriault, manual training director of the local high school. Members will hold a display of their projects in the windows of a local restaurant. . . . The center of attraction at the May meeting was a model steam engine built by Douglas Dunbar.

Newcastle (Calif.) Homeworkshop Club. Announcements have been made in local newspapers that the club will give free toys to crippled and shut-in children of the district. P. F. Hirsch is in charge.

WRITE FOR INFORMATION ON ORGANIZING A CLUB

For complete information on how to organize a home workshop club in your own neighborhood, write to the National Homeworkshop Guild, 347 Fourth Avenue, New York, and inclose a large (legal size) envelope, self-addressed and bearing a three-cent stamp. The Guild now charges no dues, and its services are given free to all home workshop clubs affiliated with it.

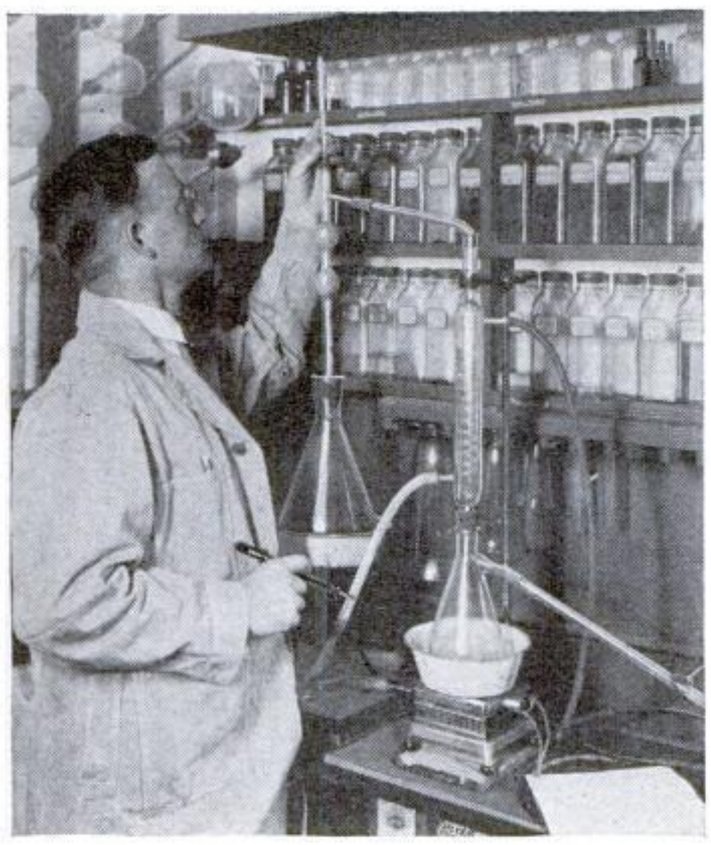
VARNISHING FURNITURE

(Continued from page 66)

the brush against the edge of the door, while the entire brush is held vertical for back-stroking the work. A running stroke with the ends of the bristles would almost inevitably cause the brush to split, and the bristles would then mar the freshly varnished face portions of the door frame.

As soon as the unit surface, as a door, drawer front, end panel, or top, is completely varnished, it should be "picked," especially under home workshop conditions, in order to remove traces of lint or other foreign material which will occasionally find their way into even the cleanest of brushed jobs.

For avoiding this dirt as far as possible, two methods are available: When the work



Mr. Waring testing varnish ingredients. It is essential, he says, for amateurs to use nothing but the best of finishing materials

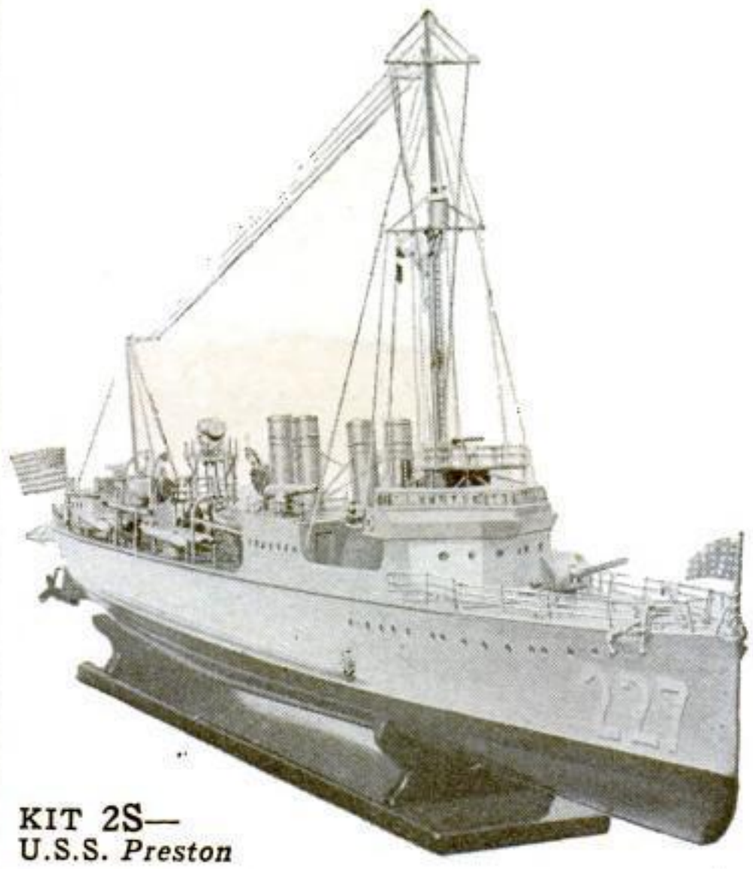
is freshly dusted off, just previous to varnishing, it is then very carefully and thoroughly gone over with a commercial "tack rag." Follow the manufacturer's directions as to the use and care of this prepared cloth, which removes and holds dust, lint, or other particles left by the duster. The use of a tack rag is definitely one of the tricks of the trade in the production of fine, clean work. Sprinkle the rag lightly with water from time to time and keep it rolled up in a piece of clean oilcloth or it will soon become worthless and hard. This is most important and should not be neglected even a minute or two.

The second and final step is also a trick of the trade. For this operation get a No. 3 or 5 artist's brush with a long handle and with a tiny point of bristles about the size of the lead tip of a freshly sharpened pencil. Place the bristles of the brush between the lips, moisten slightly, and then withdraw in such a manner as to leave the bristles in a fine, close point, which is then used to slip under and lightly lift out traces of lint.

For the beginner, it is sometimes difficult to distinguish between transparent dirt and bubbles of the same size and shape. The bubbles, however, can be easily recognized because each will have a tiny "pearl" on top caused by the refraction of the light, whereas the dirt speck will appear the same throughout. Leave the "pearls" alone for if not too numerous they will all flow out, but take great care to lift out dirt and lint specks before the varnish begins to set.

Another method of doing this same work, much in vogue with varnishers who feel that the varnish flows back better if picked with a ball of so-called "burnt varnish," consists of "cooking" one part of varnish and seven or eight parts of ordinary brown rosin in a small tin can placed in a (Continued on page 85)

ATTRACTIVE MODELS MADE WITH KITS



KIT 2S—
U.S.S. *Preston*

HAVEN'T you often envied the friend whose mantelpiece or den is enhanced with a beautiful ship model? There is no need for envy, however, because you can build an attractive model of your own by obtaining one of our construction kits and following the blueprints and instructions.

There are simplified models for the beginner and more difficult projects for the advanced model maker. A wide variety of boats can be constructed, so whether you like the clipper ship of years gone by, the show boat that was once towed up and down the Mississippi River, a modern destroyer, or an ocean liner, you will find it listed.

Each kit contains a complete assortment of carefully selected raw materials. The blocks or "lifts" for the hulls of all our standard models and many of the smaller models are sawed to shape, and the various strips of wood are cut to the correct width and thickness. Wire, rigging cord, brass, fiber, chain, and all other small supplies needed for the model are included. Preliminary work, therefore, is reduced to a minimum.

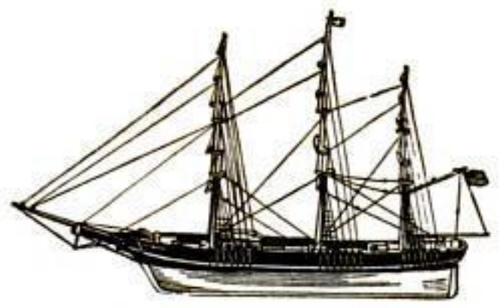
The complete list of our construction kits is as follows:

STANDARD SHIP MODEL KITS

A. Whaling Ship *Wanderer,* 20½-in....$7.40*
D. Spanish galleon, 24-in..... 6.95*
E. Battleship U.S.S. *Texas,* 3-ft..... 7.45*
G. Elizabethan galleon *Revenge,* 25-in. 7.25*
L. Farragut's flagship *Hartford,* steam-and-sail sloop-of-war, 33½-in. hull..... 8.45*
Q. Privateer *Swallow,* 12½-in. hull..... 4.95†
V. Clipper *Sovereign of the Seas,* 20½-in. hull ..... 4.95†
Y. Trading schooner, 17½-in. hull..... 4.90†
2S. U. S. Navy Destroyer *Preston,* 31½-in. hull 5.95*
3S. *Constitution* ("Old Ironsides"), 21-in. hull 6.50*
4S. Clipper ship *Great Republic,* 31½-in. hull 8.40*
5S. Coast Guard patrol boat of new 165-ft. class. Full-hull model, ⅛ in. scale, the hull being 20⅝ in. long..... 4.95*

SIMPLIFIED SHIP MODEL KITS

F. Liner S.S. *Manhattan,* 12-in..... 1.00
H. Cruiser U.S.S. *Indianapolis,* 12-in. 1.50



KIT J—*Sea Witch*

J. Clipper ship *Sea Witch,* 13-in..... 1.50

MODEL-OF-THE-MONTH KITS

M. Aircraft carrier *Saratoga,* 18-in.....$1.00
N. Four U.S. destroyers, each 6¼-in. .75
O. Liner S. S. *St. Louis,* 11-in..... 1.00
R. U. S. cruiser *Tuscaloosa,* 11¾-in... 1.00
U. *Hispaniola,* the ship in "Treasure Island," 7-in. ..... .50
Z. H.M.S. *Bounty,* 11½-in..... 1.50
1M. Show boat, illuminated, 14-in..... 1.50
2M. Ocean freighter, 14-in..... 1.50
3M. Yacht *Nourmahal,* 8⅛-in..... 1.00

KIT 1M—An illuminated show-boat model

MISCELLANEOUS

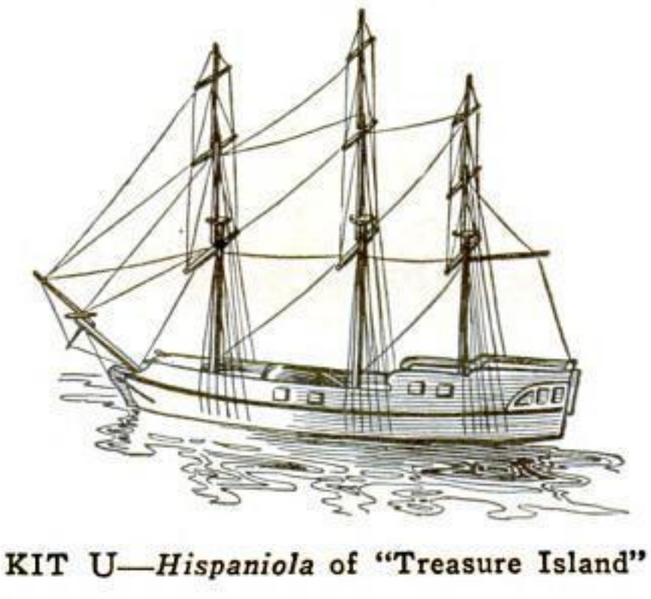
No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble, with finishes..... 5.30*

No. 5. Solid rock maple hanging wall rack with one drawer, 19½ in. wide, 33¼ in. high. Ready to assemble and stain included..... 5.75*

No. 7. Whittling kit with two shaped blocks for making sea captain 5½ in. high. A knife, three bottles of paint, pocket sharpening stone, and instructions are included..... 1.50

No. 8. Whittling kit for six different Scotties. Each is 2 by 2¼ in., sawed to shape. Paint, paintbrush, instructions, etc..... 1.00

NOTE: If you live west of the Mississippi River or in Canada, add 50 cents to all prices marked with an asterisk (*) and 25 cents to all prices marked with a dagger (†).



KIT U—*Hispaniola* of "Treasure Island"

Popular Science Monthly,
353 Fourth Avenue, New York, N. Y.

Please send me C. O. D. Kit.....

I will pay the postman the price shown above plus a few cents postage in full payment. (Canadian orders cannot be sent C. O. D.)

Name .....

Address .....

City ..... State.....

(Print name very clearly.)

If you prefer to send your remittance with this order, we will pay delivery charges. Remit by money order, check, or registered mail. This offer is made only in the United States and Canada.

VARNISHING FURNITURE

(Continued from page 83)

larger one containing boiling water. During the process, stir constantly with a wooden paddle or dowel rod until the mixture is well blended; then remove a drop and let it fall on a piece of glass. If sufficiently cooked it should form a pill stiff enough to allow molding into a ball of shoe-button size when worked on finger tips moistened with saliva. This ball should not be over 3/16 in. in diameter. Place it on the end of an applicator, one of those wooden rods about as large as the lead in a pencil used by doctors to apply cotton swabs in throat and nose examinations.

THE prepared ball is held over the speck of lint, touched to it, and then quickly lifted off. It generally takes the lint with it and allows the still wet varnish to flow back into the hole in the film. In case the ball fails to lift the lint or dirt the first time, tap it lightly against the heel of the hand to make the burnt varnish sticky again, and once more touch the lint or dust speck. Once in a great while, a piece of lint becomes caught on a panel and cannot be removed. Leave it alone with the assurance that if the work is well dried and properly sanded or rubbed, it will not "pull out."

One of the hardest problems in dust and dirt control, it may be added parenthetically, is solved by sensible and adequate housekeeping. Have some quiet place prepared ten hours ahead of time and cleaned with a damp cloth and mop. See that the windows are tight and are left locked. Do not allow anyone to enter the room before you use it, and do not take visitors in to see your work during the drying period. Do not go in yourself if you can avoid it.

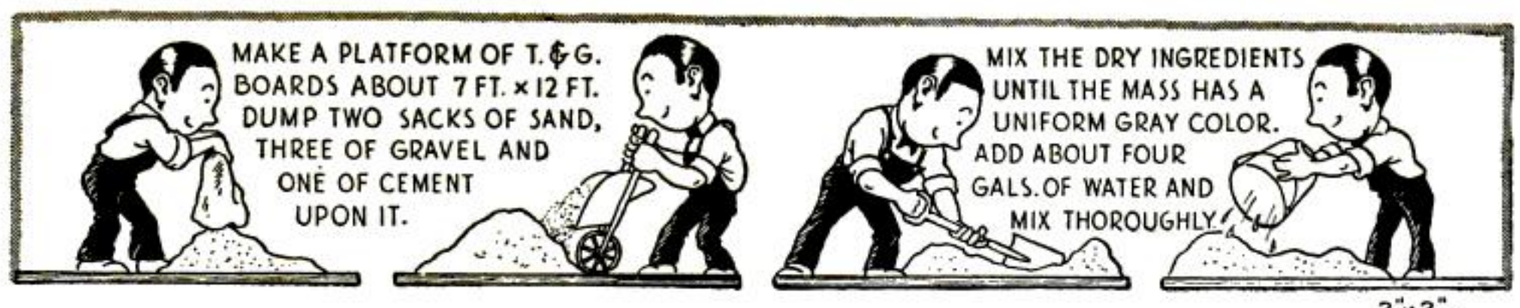
It is best, if possible, to set aside a small room, at least temporarily; keep it clean; wipe the walls; wipe the window sills and frames; mop the floor; put weather strip across the door bottom if necessary. Wipe off all table and stand equipment taken into the room, and keep yourself as dust free as possible. This means that you should dampen your hair with a wet comb; wear the crown of an old felt hat with the brim removed; take off your long-sleeved cotton shirt and substitute an old one with the sleeves cut off and hemmed, or wear a gym shirt. If you wash your arms before going to work, there will be little chance that they will shed any lint.

AFTER you have used the picking stick, under no circumstances must you re-brush the surface in case the hole does not fill up by having the varnish flow back into place. You have simply been too slow in your brush-work, and the varnish has set. To brush it again with fresh material would only result in a detestable condition known as "piling up."

Good brushing practice is aided by a few simple pieces of equipment. A paint stand with metal top and bottom shelves should be made as shown in a previous issue (P. S. M., June '36, p. 66). The design was developed through years of study and constant use in the trade.

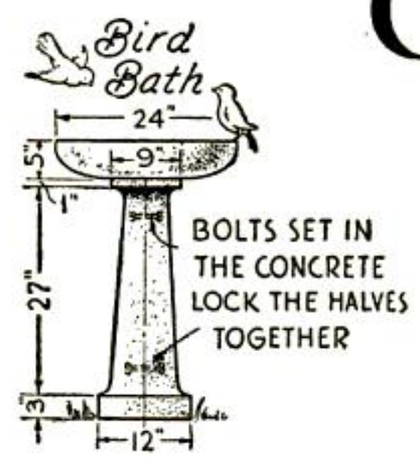
Two of the accompanying photos show the work supported on a stand with a revolving top. It was made from a broken piece of drawing equipment. An old washing machine or dress form found in a junk yard or second-hand shop might furnish a similar tripod base for such a stand. Fitted with two or three sizes of metal-covered wooden tops, such equipment helps to turn out fine work under better working conditions.

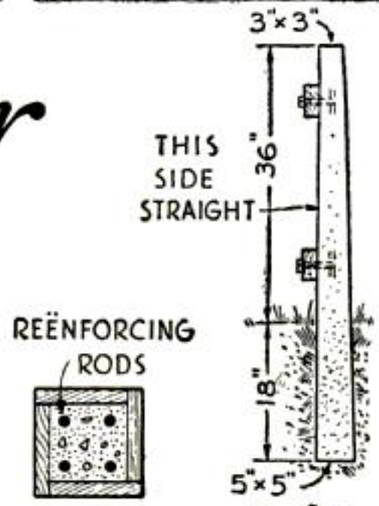
Last of all, see to it that the brushes are kept in clean containers; that their bristles are clear of the bottom; and that the level of the liquid is always up on the ferrule, so that partial hardening of the varnish cannot make a "seedy" brush.

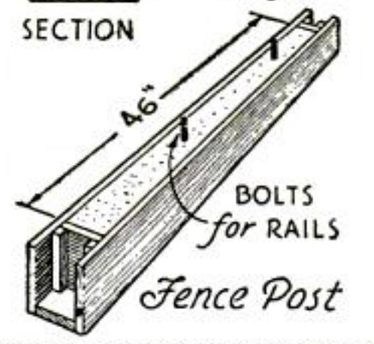


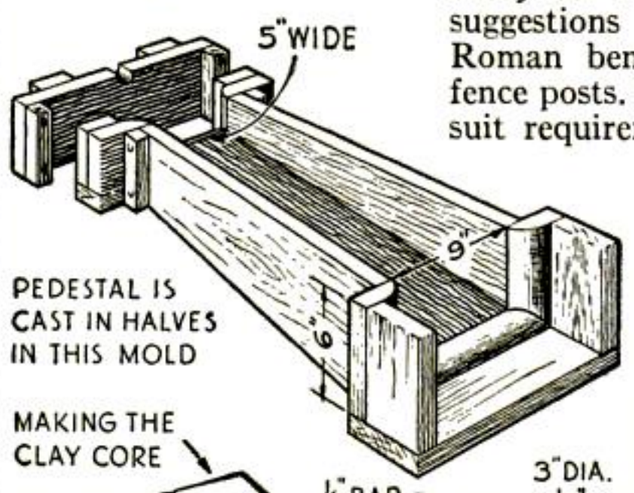
Concrete *for the* Garden

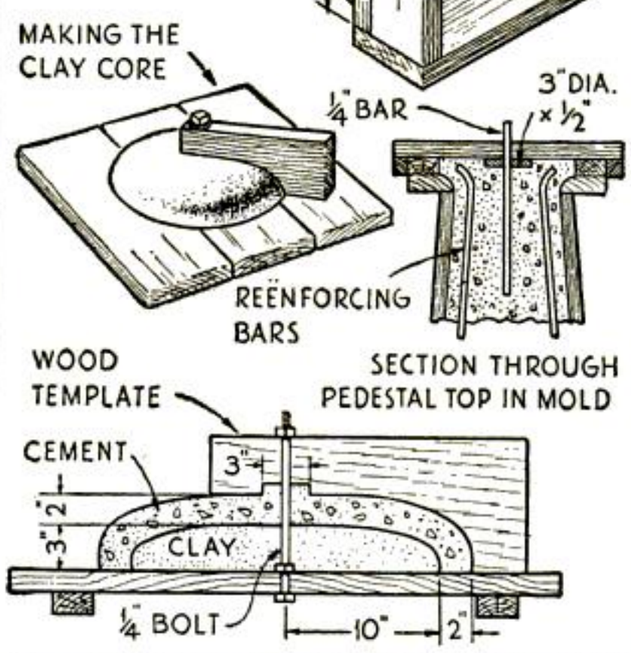
CONCRETE is so easy to cast in wooden forms that it is an excellent material from which to construct substantial pieces of garden furniture and flagstone walks. Properly mixed, it will last indefinitely. In the accompanying drawings are suggestions for a bird bath, flowerpot, Roman bench, lily pool, flagstones, and fence posts. Dimensions may be changed to suit requirements.—DICK HIXON.

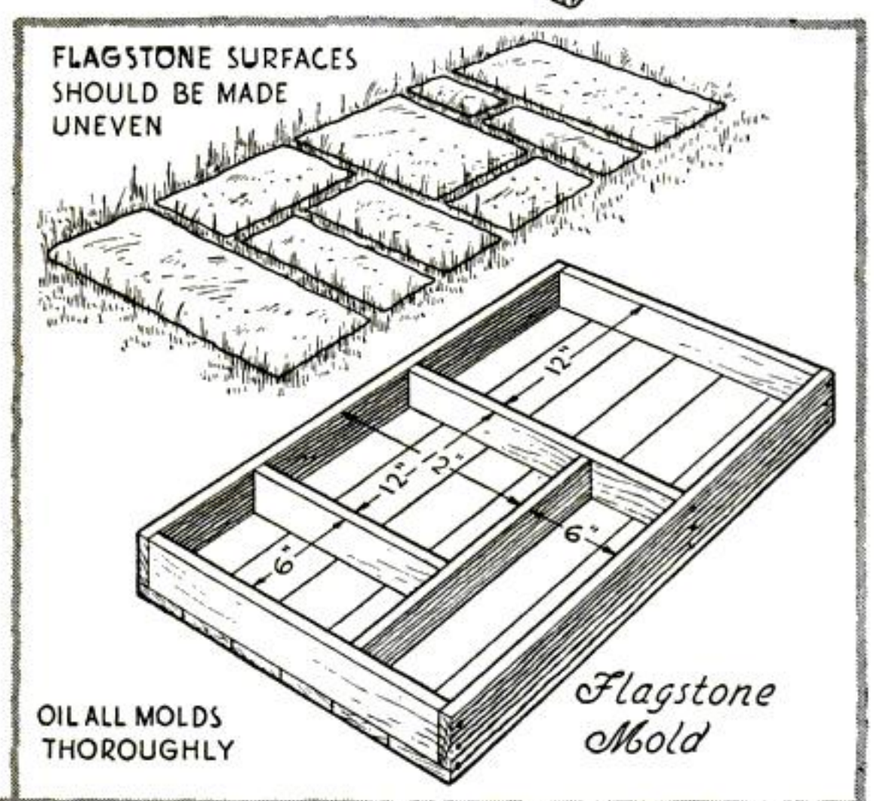


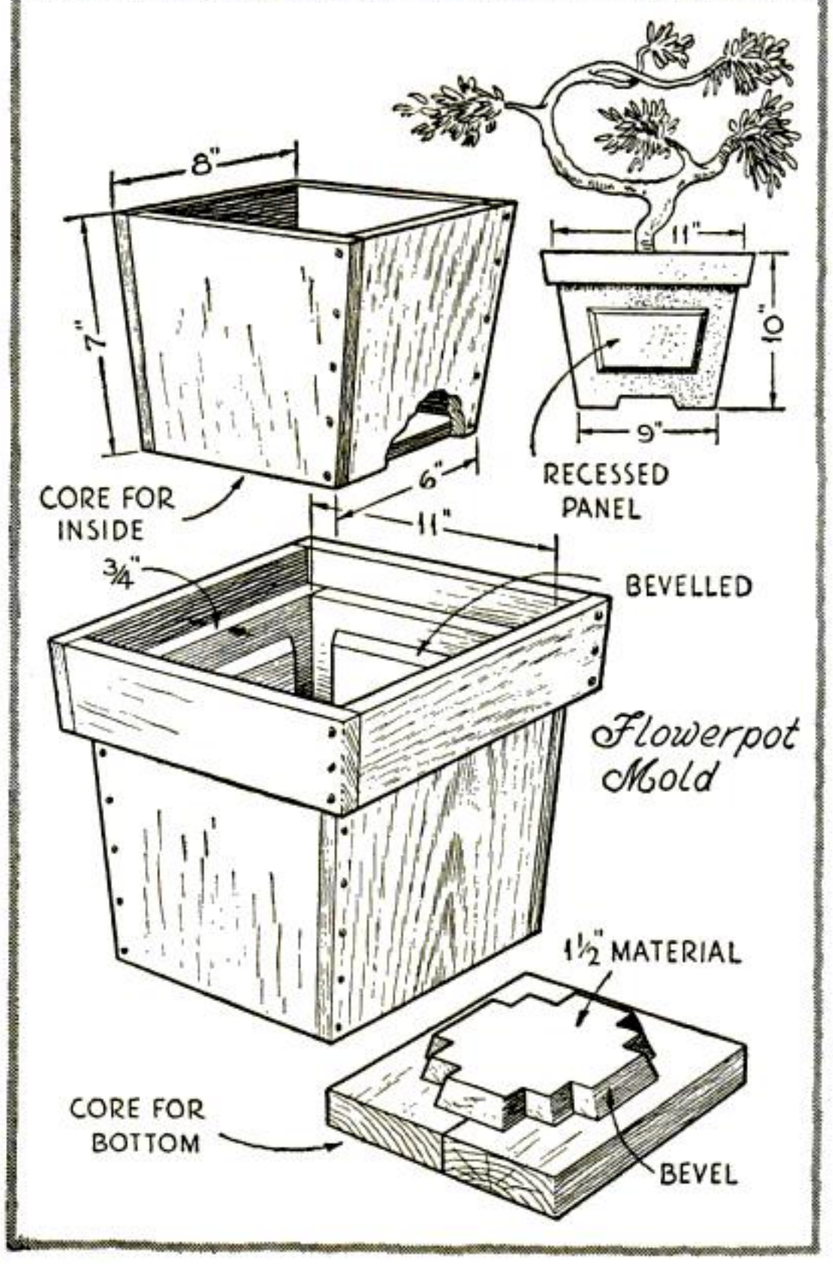


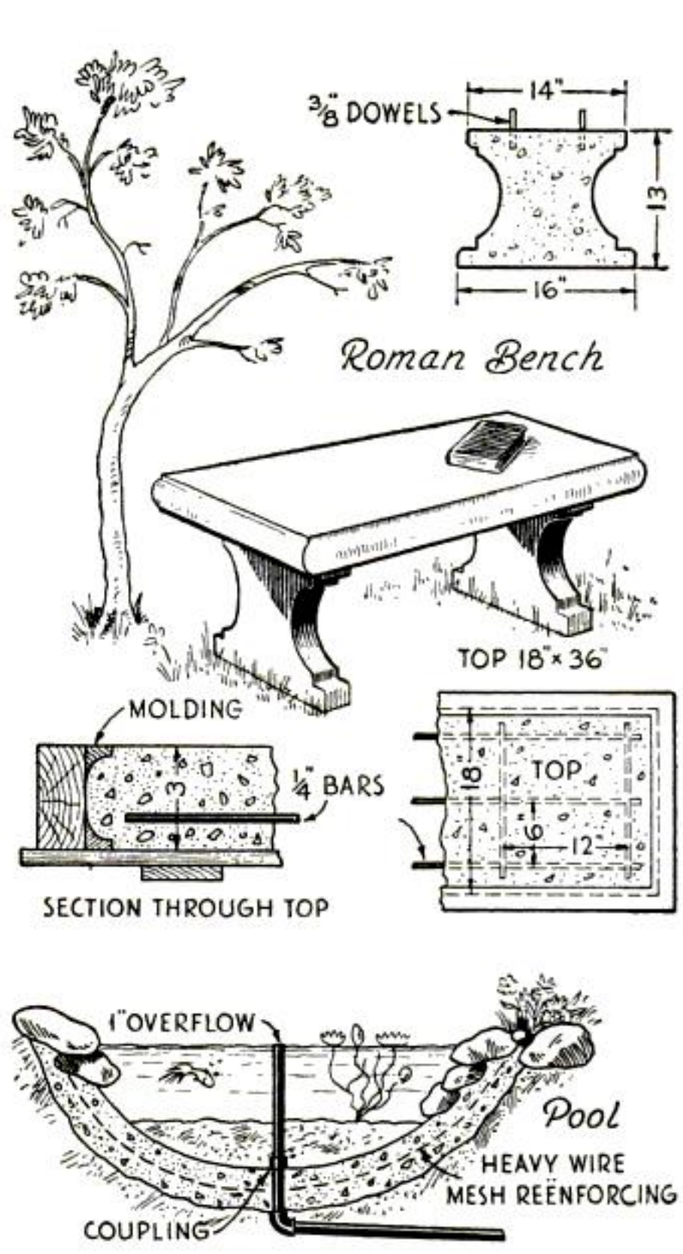












Sketches showing a variety of ways to make wooden forms and use concrete for garden accessories

SYNCHRONIZER SETS OFF PHOTOFLASH BULBS

(Continued from page 74)

mark the outline of the holes in the contact strip on the composition plate. Drill the plate at the marked locations, and tap the holes to take small machine screws. (No. 2-56 screws are about right.) Screw the contact strip on the composition plate, taking care that the screws do not touch the shuttter plate, and adjust so that the trip lever just touches it when the shutter opens. Trim off all surplus metal, and make sure that the contact assembly clears as the camera is closed.

THE battery case, socket, and reflector were made in one piece from a flash-light case, a standard socket (keyless), and a tin lamp shade. The assembly was mounted on a strip of 1/8-in. brass as wide as the diameter of the flash light and about 5 in. long. This was attached to the camera by a 1/4-in. No. 20 screw through the tripod socket.

The case of a standard socket was sweated with solder into the lens ring of the flash light, the shell of the socket being connected to the case. A spring was soldered on the center terminal of the socket and bent around under the porcelain to contact the center of a flash-light cell. The lens ring, containing the socket, was screwed on the flash-light case, and the lamp shade on the threads on the socket case.

After the spring had been removed from the bottom cap of the case, the cap was sweated onto the brass supporting strip. A disk was cut from insulating composition and placed inside the cap, and the spring attached with machine screws. The disk and base were drilled to clear an insulated binding post, the binding post screwed in, and the spring connected to it. With the cells in place, and the bottom cap screwed on, the socket could then be made "live" by connecting the binding post on the bottom of the assembly with the case of the flash light.

THE end of the supporting strip was drilled to clear a 1/4-in. screw, and a cleat attached to the top at the edge of the camera bed to keep the flash assembly from turning. To prevent the possible loss of the 1/4-in. thumb screw, it was fastened to the supporting bar with a bridle made of 1/16-in. strip brass, as shown. The screw was put through the strip, and a collar pinned on; then the strip was bent to fit and screwed on the supporting bar.

Connection between the terminal on the bottom of the supporting bar and the contact strip is made with a flexible cord, armored with windshield-wiper tubing. To fit the insulated terminal on the flash assembly, a cord tip was used. At the other end, no standard connector being suitable, a screw clamp made of insulating composition and alarm-clock parts was used.

Operation may be checked by substituting a 1½-volt flash lamp for a photoflash bulb. To test synchronization, remove the film from the camera, place the flash lamp in the socket (using an adapter), and in a darkened room look through the back of the camera as the shutter is tripped.

Exposures when using flash bulbs are not critical. There is a latitude of 25 percent in either direction with the following data, which is for film of the panatomic type.

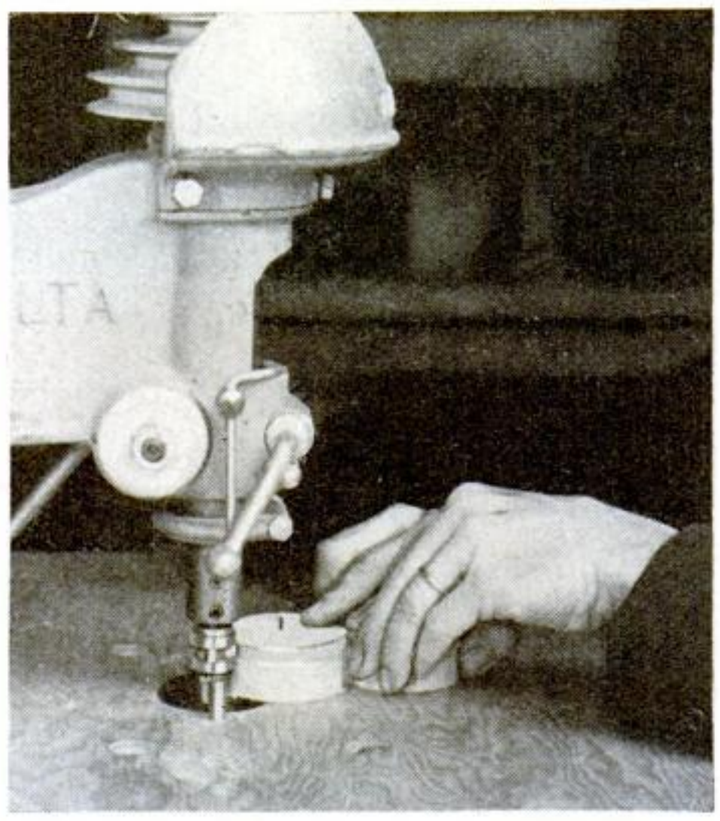
Aperture	Distance			
	5 ft.	7.5 ft.	10 ft.	15 ft.
F/5.6			S	L
8		S	L	
11	S	L		
16	L			

NOTE: S stands for the small size or 15-cent photoflash; L for the large or 25-cent size.

When supersensitive panchromatic film is used, the same density negatives will be obtained with half the exposure.

FIVE-CANDLE LAMP OF SEVEN SHAPES

(Continued from page 58)

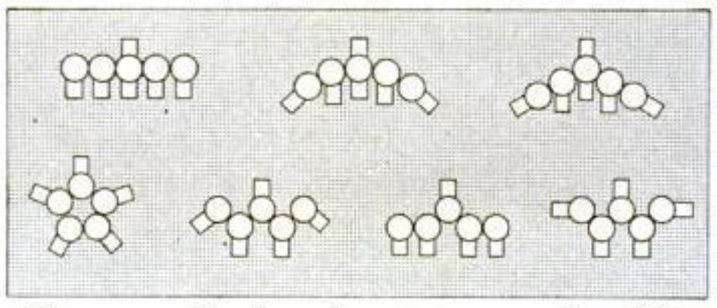


Using the drill-press shaper attachment to round the edges of the upper links, which are tacked to a template of thicker wood

uppermost) and also on one disk. If this is done on a shaper, saw out a guide block of 1-in. stock to the same shape, and on top of this tack the link to be molded. The links used underneath have only the upper corners rounded.

Six feet are required for this lamp. They consist of forked blocks notched on the undersides as shown. An easy way to cut the 7/16-in. cove in the front of a foot is to do it on a molding head used on a circular saw, with the end sliding against the fence, and the sides gripped in a hand screw. This gives ample holding power and keeps the fingers out of danger. The smaller coves are cut on a spindle shaper, or a drill press adapted for shaping. If you have no equipment for making moldings, omit this detail. The rest can be done with ordinary machines, or by hand.

The parts are finished before assembly. A satisfactory finish is to give the walnut parts one coat of thin white shellac and rub them down lightly with fine steel wool to remove any raised grain. Then mix a stiff paste of furniture wax and pumice stone and rub it well into all surfaces. When this filler has dried until the pumice shows white, wipe off across the grain with a cloth, and polish by rubbing. The antique effect thus obtained is very attractive. The candles are given



Diagrams showing the seven ways in which the candles may be arranged to form lamps

three or more coats of ivory enamel, all undercoats being lightly sanded.

To assemble, lay the candleholders in a row, and slip an upper base disk over the tenon of the one at the left. Link the next two, and then the last two. Now cut waxed-paper washers about ½ in. wider all around than the links and disks and force them over the tenons to prevent glue from reaching the upper links. The holes should fit snugly. Coat the tenons with glue, apply glue to the holes in the lower links, and put them on—a link over the two candleholders at the left, another link, and lastly a disk. This effectually joins the candlesticks together while permitting them to move to the shape desired.

When the glue has dried, tear out the waxed-paper washers, and nail onto the ends of the tenons sheet-iron washers 1½ in. in diameter. Also glue the candles into the holders.

Use weatherproof sockets for the candles. Crack the composition shells with a hammer, strip off the pieces, and splice out the pigtails with short pieces of lamp cord. Tape the joints, threading the wire through the fixtures. Cut a jacket of heavy fiber paper to inclose the screw part of a socket and push it into the candle until it seats with the upper edge showing about ⅛ in.

One end socket can be connected directly to the cord for the lamp. The others must be spliced into this wire, but they can be connected in pairs, thus the insulation will have to be removed from only two places, instead of four, as would be the case if the sockets were separately connected. These joints must be taped and pressed as compactly against the underside of the base as possible.

To set up the lamp, bend the base into the shape desired and push the foot forks over the tenons. The washers prevent them from slipping off the ends and turn them into sufficiently rigid mounts. They may be pointed in any direction desired, to adapt them to the form the lamp takes.

Fit the candelabra with flame-shaped bulbs.—EDWIN M. LOVE.

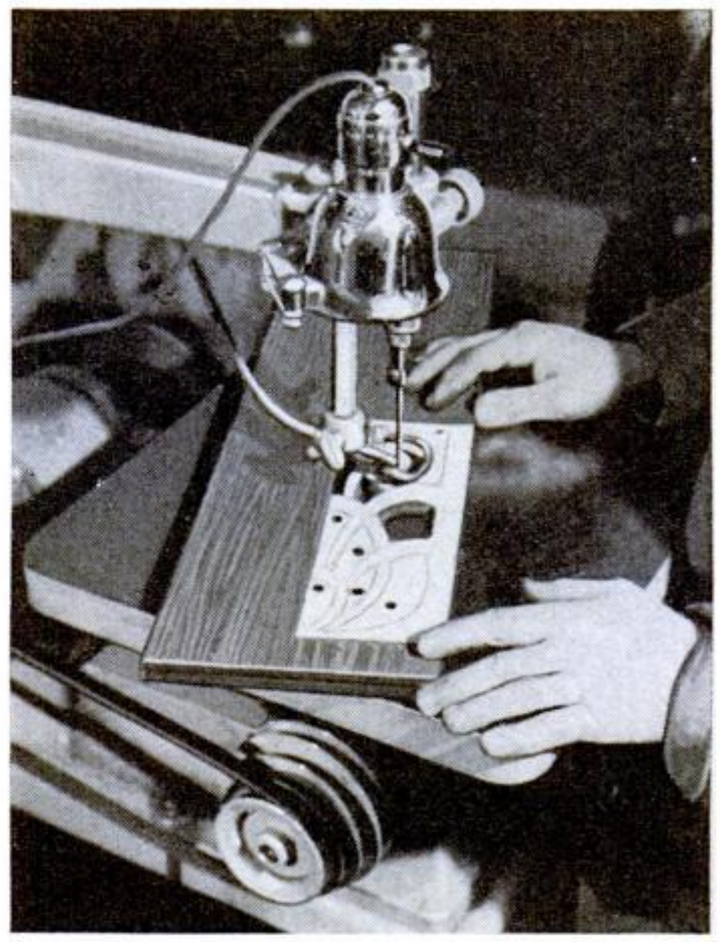
ANTIQUE BOOKSHELF HAS BLUE MIRROR BACK

(Continued from page 59)

on the wood with rubber cement. In using this cement, apply a coating to both wood and pattern and allow the coating to dry thoroughly. Then place the paper carefully in position and rub out any entrapped air. The two sides should be tacked together with ½-in. brads through the waste strip at the ends, and the quarter of the design cut in both pieces at once, as shown in one of the illustrations. Temporarily separate the sides and after smoothing up the sawed outline, use the second piece as a pattern to complete the design.

Do all possible scraping and sanding before gluing the sides and shelves to the back frame.

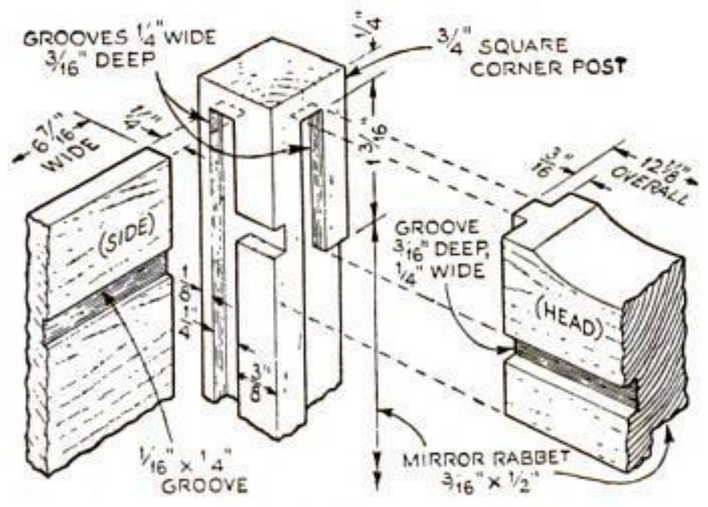
As the application of the standard stain, filler, and varnish *(Continued on page 89)*



The two panels are tacked together, a quarter of the design sawed, and then one panel is used to mark the full design on the other

ANTIQUE BOOKSHELF HAS BLUE MIRROR BACK

(Continued from page 88)



Detail of Corner Joint

How parts are grooved. A saw, vertical spindle shaper, or routing cutter may be used

is very tedious work on scroll-sawed work and in interior corners, the use of a different type of finish is suggested. This consists of a commercially obtainable stain and wax carried in a penetrating oil, which give a finish closely approaching the results obtained by old-time methods. This is flowed on copiously with a soft brush and rubbed in with a rag after a half-hour interval. Two or three applications may be used at intervals of at least a day.

The hangers are simply metal straps with two countersunk holes for ½-in. No. 4 screws (for attaching to the ends of the corner posts) and 3/16-in. holes in the extended portion for long, thin screws into the wall. The projecting portions may be finished with dead black enamel.

The mirror should lie flat in its rabbet so that no strain will be placed on it when the retaining stops are bradded in place. A layer of thin cardboard over the mirror back is recommended to give a cushioning effect and to protect the mirror coating from being accidentally scratched.—DONALD A. PRICE.

List of Materials

No. of Pieces	Description	T.	W.	L.
2	Sides	1/4	6-7/16	21
3	Shelves	1/4	6-5/16	12 5/8
2	Corner posts	3/4	3/4	21 1/4
1	Headpiece (over tenons)	3/4	2 5/8	12 1/8
1	Tailpiece (over tenons)	3/4	1 3/8	12 1/8
1	Mirror, plate glass	1/4	12	18 1/2
2	Mirror stops	3/16	3/16	18
1	Mirror stop	3/16	3/16	12
1	Cardboard backing		12	18 1/2
4	Metal hangers	1/16	5/8	2 1/2

NOTE: All wood to be mahogany or walnut. The dimensions are given in inches and represent finished over-all sizes.

SCRAPS OF ELECTRIC CONDUIT MAKE USEFUL BRACES

SHORT sections of thin wall electric conduit make excellent braces, hangers, and supports. Beat the ends flat and drill for mounting holes. The flattened ends may be bent around conduits and drawn up tight with a bolt; the other end anchored to wall, ceiling, or another conduit. Short scrap pieces make excellent angle braces for shelving, platforms, and the like when mounted against a wall. The rigidity of tubing used in this manner is equal to, and often better than, strap iron; and because of its lightness and ease with which it can be drilled and bent, it can be installed much faster than strap iron.

Old Bill SAYS:

FOR lapping bores of cylinders, sleeves, and similar parts, the work preferably should revolve, not the lap. Best results are obtained with a vertical set-up.

Blue vitriol will give a copper coating to brass if a little cast-iron dust is applied to the surface.

• • •

Much of the breakage of small wire drills is due to lack of speed, so don't be afraid to speed them up.

• • •

When a crosspiece of wood is driven into a bore in order to locate a center for lay-out work, there is often a tendency for the wood to swivel. To prevent this, drive another short piece of wood at right angles between the wall of the bore and the first piece. Then tack a piece of tin in the center of the crosspiece for laying out a more accurate center.

• • •

If a steel bushing with a standard allowance for a drive fit is packed in cracked ice for a half hour, only half pressure is needed.

• • •

High-speed steel should never be peened, either before or after hardening.

BLUEPRINTS MAKE YOUR WORK EASIER

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Our blueprints have been prepared by experts and are, for the most part, 15 by 22 in. They cost 25 cents a sheet (except in a few special cases) and should be ordered by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means that there are two more blueprints in the complete set.

SHIP AND COACH MODELS

{Construction kits are available for some of these models. See page 84.}

Baltimore Clipper (8-in.), wooden sails, *92*	.25
Battleship *Texas* (3-ft. hull), *197-198-199-200*	1.00
Clipper Ship *Great Republic* (31½-in. hull), *272-273-274-R*	1.25
Clipper Ship in a Bottle, *121-122*	.50
Coast Guard Patrol Boat (20⅝-in.), *286-287*	.50
Constitution (21-in. hull), *57-58-59-R*	1.00
Freighter, Ocean (14-in.), *271*	.25
Galleon *Revenge* (25-in.), *206-207-208-209*	1.00
Hartford, Farragut's Flagship (33½-in. hull), special prints *221-222-R*	1.50
H. M. S. *Bounty* (8½-in. hull), *254*	.25
Mayflower (17½-in. hull), *83-84-85-R*	1.00
Motor Boat, Working Model (20-in.), *196*	.25
Nourmahal, power yacht (8⅛-in.), *276*	.25
Liner—*Aquitania* (9-in.), *225*	.25
Liner—*California* (12½-in.), *251*	.25
Liner—*Normandie* (20⅝-in.), *264-265*	.50
Liner—*Queen Mary* (10¼-in.), *283*	.25
Pirate Felucca (20-in.), *44-45-R*	.75
Privateer of 1812—*Swallow*, a Baltimore clipper (13-in. hull), *228-229-230-R*	1.00
Santa Maria (18-in. hull), *74-75-76-R*	1.00
Stagecoach with Horses, *144-145-146-R*	1.00
Steamboat, Mississippi (19½-in.), *94-95-96-R*	1.00
Trading Schooner (17½-in. hull), *252-253*	.50
Tugboat, Harbor (11⅜-in.), *284*	.25
Tugboat, Water-Line (5 3/16-in.) and Barge (7 3/16-in.), *285*	.25
Whaler—*Wanderer* (20½-in.), *151* to *154*	1.00
Yacht *Rainbow* (7½-in. hull), *233*	.25
Yacht (20-in. racing), *48-R*	.50

BOATS

Canoe Sailing Outfit, lateen sail, *25*	.25
Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., *192-193-194-R*	1.00
Duck Boat, Canvas Covered (13 ft. 6 in. long; weighs 60 lb.), *279-R*	.50
Duck Boat, Folding, (13-ft.), *170-R*	.50
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), *257*	.25
Installing Inboard Motors, *270*	.25
Outboard Racer for Class "A" and "B" Motors (10 ft. 4 in. long), *211-212-R*	.75
13-ft. Motorboat-Rowboat (has decked hull; for use with outboard or inboard drives and oars), *147-R*	.50
15½-ft. Runabout or "Sportboat" (outboard or inboard motor), *175-176-177-R*	1.00
13-ft. Utility Rowboat (can be sailed or used with outboard motor), *224-R*	.50
13-ft. Racing Runabout, *261-262-R*	.75
Utility Boat for Campers (11 ft. 2 in. long, canvas covered; for rowing or outboard motor), *281-R*	.50

RADIO SETS

All-Wave Portable (battery), *217-R*	.50
Amateur Short Wave Receiver, *155*	.25
Amateur Radio Transmitter, *183-184*	.50
Five-Tube Short Wave (A.C. or D.C.), *223*	.25
Full Electric Headphone Set, *130*	.25
One Tube (battery operated), *103*	.25
Screen-Grid Set, *109*	.25
Short-Wave Converter Unit, *137*	.25

FURNITURE

Broom Cabinet, *49*	.25
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End Table, American Empire, *241A*	.25
Fireside Seats (wood and metal), *266A*	.25
Floor Lamp with Tripod Base, *243A*	.25
Hanging Wall Cabinet, Colonial, *280A*	.25
Lamps, Three Modern, *93*	.25
Magazine Rack, Ladder-Back Style, *250A*	.25
Mirror Frame, 20 by 30 in., *246A*	.25
Modernistic Book Ends, Low Stand, and Bookshelf, *100*	.25
Sewing Cabinets, Two, *31*	.25
Smoking Stand, Modern, *238A*	.25
Stool, Scoop-Seat, *242A*	.25
Stool, Upholstered, *240A*	.25
Table, Four-Leaf Card, *239A*	.25
Tables, Tile-Top, *249A*	.25
Tavern Table and Scroll Mirror, *105*	.25

MISCELLANEOUS and TOYS

Airplane Model, Flying—*Winnie Mae*, 4-ft. *141-142-143*	.75
Hand Loom, Four-Treadle, *268A-269A*	.75
Microscope Kit, Portable, *220*	.25
Perpetual Star Chart, *214*	.25
Projector for Photos and Pictures, *259A*	.25
Toy Birds and Animals, Jig-Sawed, *56*	.25
Toy Drill Press, Lathe, Saw, etc., *113*	.25
Toy Dump Truck, Fire Engine, etc., *101*	.25
Weather Vane, Ship Model Type, *66*	.25

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PANELED CABINET AND CUPBOARD DOORS

(Continued from page 71)

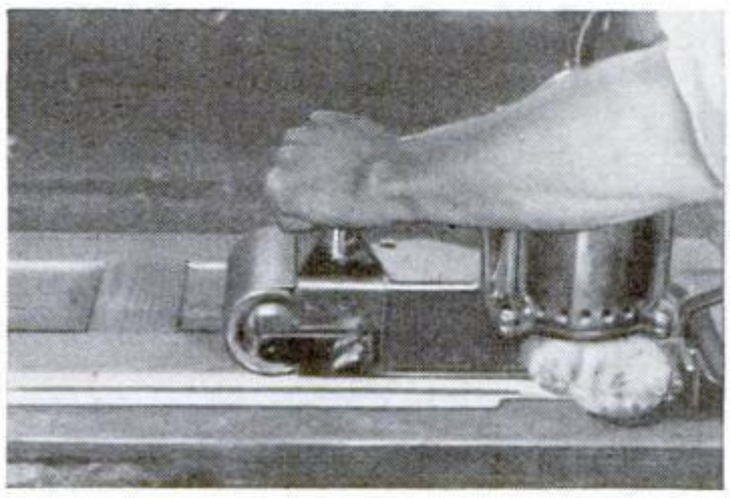


Fig. 10. Doors are sanded diagonally, then with the grain if the finish is to be natural

exaggerated diagram of this operation. You will see that if the rail end be slightly out of square, this procedure will leave the face side shoulder minutely longer than the back one. This assures the best fit on the front of the finished door. (Mention of such small details may appear superfluous, but if our method of work tends to correct possible errors, it will save much time.)

Assembling frame and cutting panel. Mark the length of the door on the stiles. As they are longer than necessary, a piece will be left at each end. These are the "horns," which serve to protect the door till fitted. In addition, it is well to be slightly oversize in actual length as in width because this will permit fitting the door to a slightly out-of-square opening.

Assemble the door (Fig. 7) and determine the panel size. Measure between the stiles and add 1⅛ in. to find the panel width; likewise, between the rails to get the length. This will leave the panel ⅛ in. less both ways than would completely fill the grooves. This is done to assure easy assembly of the door.

Gluing up. After cutting the panel, assemble the door completely. If all is well, place the door horizontally in the vise. Tap up and off the upper stile and apply glue to tenon, shoulders, and grooves, as well as at a point or two along the groove to grip the panel (Fig. 8). Repeat on the other side of the door. When you apply the clamps, test occasionally for squareness and avoid undue pressure.

Doweling. When the glue has set, the clamps are removed (the next day) and the stiles are

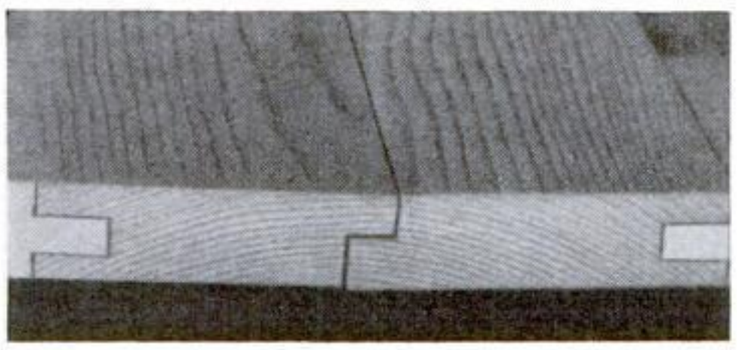


Fig. 11. When two doors meet with a joint of this type, one stile must be made wider than the other by the width of the lap so that both will show the same width from the face side when the doors are hung in place

drilled through the edge and into the rails as shown in Fig. 9 and the drawing. These holes are for the dowels. The dowel does not run continuously through the stile, but is cut off about 2½ in. in length and driven or set into the hole with a ¼-in. piece of rod. The exposed hole in the edge of the door is then plugged with another short piece of dowel. This is done so as to permit natural shrinkage of the stile, without either breaking away from the dowel or becoming split itself, which might easily happen if the dowel passed completely through the stile. Two dowels at each bottom corner and one at the two top corners will be sufficient. This method of placing the dowels from out- (Continued on page 95)

NEW THERMAL HUNTER PLANE MODEL

(Continued from page 61)

for fastening to the propeller as shown.

The front plug and the propeller can be assembled by making the rubber end of the propeller shaft first. Slip on the plug, ball-bearing washer, and then the prop. Hold the propeller in place by bending the spiral engaging hook as shown. If your local supply shop does not have the ball-bearing washer, three well-oiled flat washers will do.

THE stabilizer is made over a full-size outline and rib plan. The bamboo tips are bent in one piece held over a gas flame or heated metal until the bamboo is pliable for shaping to the outline by hand. The curve, when cold, is cut in two halves, which are trimmed to size and cemented to the spars. Remove the stabilizer and check for perfect taper by sighting along the curved rib edges, and sanding down the high points. Cover the center section with 1/32-in. balsa, top and bottom. Sand and smooth all rough spots. Cement the finished stabilizer on the stringers as shown, and be sure that it is horizontal.

The rudder, minus the lower rib, is assembled on the full-size plans. Cement the front spar to the cross brace, and rear spar to the stabilizer. Fit in the bottom rib and cement it to the rudder and stabilizer. The skid portion is made by bending the bamboo to shape and fixing it to the lower cross brace, to the end of the longerons, and to the rudder's trailing edge. The bamboo outline is stiffened by a laminated balsa assembly, which is cemented to the outline and the lower portion of the stabilizer. The skid is held centrally by balsa sheets cemented to the longerons and skid sides. Finish the tail by covering the front portion of the rudder with balsa sheet.

Before cutting the longerons at the plug end, make eight small hooks, which are bound and cemented to the longerons as shown. After the two sections are separated, reënforce the front square with cement fillets. Into the rear part fit two balsa laminated squares with the end hook attached as shown. Be sure that they are strongly made since they have to take care of the rubber torque.

The wing is made over a full-size outline. Make full-size drawings of the ribs, transfer the outlines to the balsa, and cut the ribs with a razor blade exactly on the line. Note the two small cutouts for center spars. Rib No. 1 and No. 2 have an extra cutout near the trailing edge for the reënforcing spar. Taper the spars to the sizes shown.

MAKE the wing in two halves. Set the finished halves over the plan, hold the center ribs in place with pins, and raise and block the tips 3 in. for the dihedral. Cement in place the center section spars, fillets, and other reënforcing members. Let set for a quarter of an hour; remove, and fix in the lower center spar and the short rear spar.

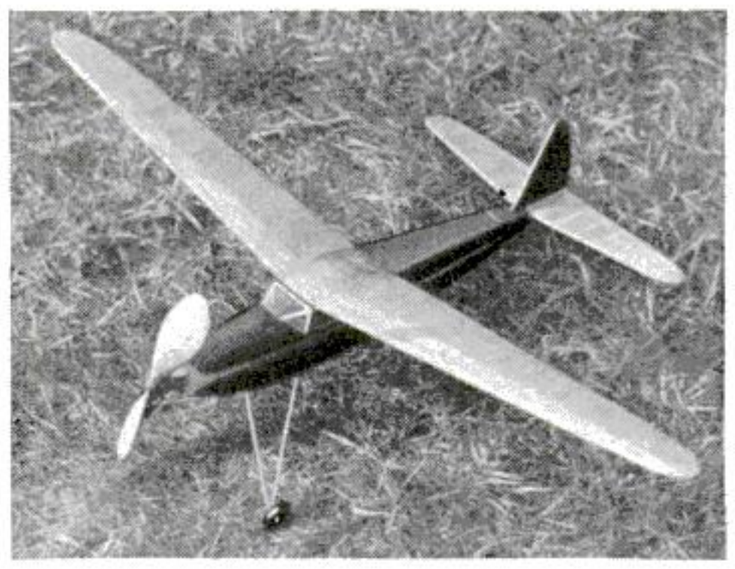
The strength of the wing is almost doubled by covering the leading and center portion with a balsa sheet, as shown by the grain lines. Work from the center spar out, and let the sheet overlap the leading edge. This portion can be sanded later to the rib outline. Sand and finish with No. 10/0 sandpaper.

Colored tissue is used for covering, yellow for the wing and stabilizer, and red for the fuselage and rudder. On this kind of paper the grain must be lengthwise on fuselage and spanwise on wing and tail. Use dope for cement. Cut the paper to an approximate size and tack it at only one point on the middle of the center rib. Now coat the entire tip rib and cement the paper to it so that it will form a smooth triangle with the apex at the center. Keep the tension while the dope is setting. Finish the covering by coating spars and fixing paper from tip toward center. The next operation is to break the center tack and cement the paper on the center portion of the wing or tail surface. The paper will be fastened to the uncemented ribs when the surfaces are doped. On the fuselage the paper must be cemented to all the uprights and cross braces.

The wrinkles are removed by wetting the paper with water. While the paper is drying, the wing or tail can be straightened.

The model is coated with one or two applications of regular model dope. The celluloid windows are then cut and cemented.

Assemble the model with rubber bands. Make up a 10-strand motor of 1/8-in. flat rubber, brown preferred, and place it inside the fuselage. Be sure to use safety hooks throughout. Check the line-up. Everything should be straight except the right wing, facing the model, which should have a slight "wash-in" to counteract the torque. It is very important that the model is balanced exactly 1½ in. behind the leading edge on the center portion. If the balance is off, correct it by adding the required weight.



The model lands safely from a test flight

Test flights should be made on calm days or during the twilight when the wind dies down. For the first glide, the motor is wound 50 to 70 turns. If it flies well on this power, try more turns. If the model stalls on this low wind-up, check the C.G. If the C.G. is all right, note if the incidence of the stabilizer is too negative. A dive calls for the same check up except that the stabilizer might be positive. Correct any misalignments found, and make another test. If it still misbehaves, keep on checking the wing, the C.G., and the tail settings.

If the model tends to bank sharply, check the incidence of the wing which is on the outside of the circle and also the rudder setting. Decrease the incidence or neutralize the rudder. By now the model should behave fairly well, and it can be wound up from 250 to 300 turns for checking the glide.

After the model is fairly stable, it is wound about 400 turns, and then hand launched into the breeze. The glide should be flat without stalling and should circle to the right.

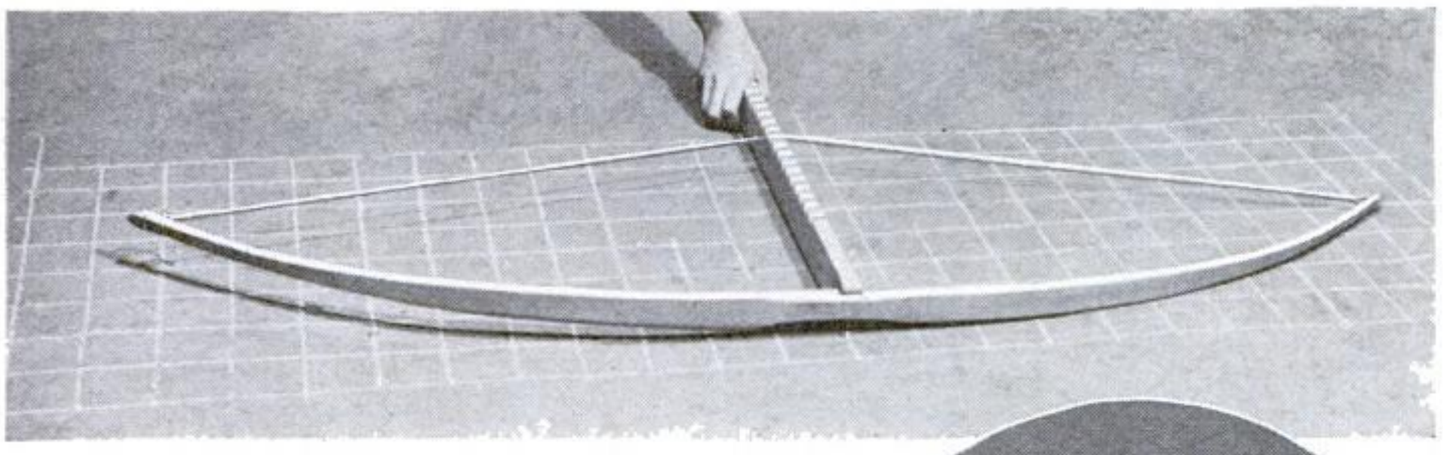
The climb adjustments are made by offsetting the thrust line. If the model has a tendency to stall, the propeller is pointed down by placing a balsa strip between the plug and the fuselage. Keep on adding down thrust until a smooth climb is obtained. If the model has a tendency to spiral with the torque, have the prop. pull to the right side until the ship climbs straight up or with a slight left turn. After the correct offsetting is found, the plug can be cut to suit.

For contest or endurance flights, the rubber is lubricated, stretched three times its length, and wound about 800 turns with a geared winder.

The model conforms to the National Aeronautic Association model competition rules, both in fuselage cross section and wing loading of 1 oz. per 50 sq. in. of wing area.

THE NEW AMERICAN FLAT BOW

(Continued from page 56)



Testing the curve of the tillered bow on a gridiron chalked on the floor. *In circle:* Using a spokeshave to cut the belly down to guide lines

Place the bow in the vise and have an assistant pull carefully on the lower tip while you pull the upper and slip the loop in place in the nock. Do not push on the limbs, for a breaking bow nearly always throws splinters forward with murderous force. The string is likely to stretch considerably, and you will have to adjust the timber hitch several times before you hold the bow bent to any great depth.

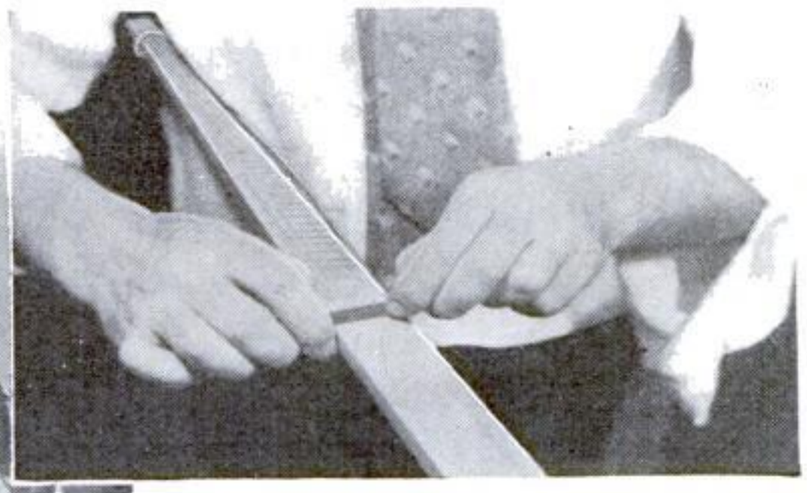
As soon as you have a bend of some 5 or 6 in. in the bow, place the tiller on the handle and hold the bow, back down, on the floor, steadying it with your toes. Then pull the string up a few notches on the tiller with both hands. Have your assistant ready with a piece of chalk to mark any section which does not bend evenly, for the whole bow must contribute to the shot if you are to obtain the utmost efficiency.

Let the bow down, unbrace it—that is, slip the loop out of the upper nock—and replace in the vise for scraping at the spots marked by the chalk. To make sure that the whole section is reduced evenly, rub the part to be scraped with soft pencil lead. By scraping the marks away, you remove a thin layer of wood and will not risk reducing one side more than the other.

Flat bows bend in a different arc than ordinary long bows—practically a perfect arc, slightly flattened in the center opposite the grip. So slight is this flattening that the radius of the curve of each limb should be the same as the length of the draw—in this case 28 in. If a template like that on the following page is laid on the floor and the bow worked down carefully until it fits neatly within the arcs, you are practically sure to produce a bow which will give flat trajectory, good distance, and little jar. Do not keep the bow at full draw more than a few seconds at a time.

Generally speaking, the bend should show first in the center of the limbs, then in toward the grip, and lastly in the third of the limbs nearest the tips. Allowing the tips to bend too early in the work weakens them excessively and produces what are known as "whip ends."

Finally the corners of the limbs are rounded slightly to lessen the danger of denting. Draw a line 1/16 in. each side of the back corners and 3/32 in. from the belly corners and round only to these lines. Sand with No. 6/0 garnet paper until fairly smooth and rub on a good coat of shellac. *(Continued on page 94)*

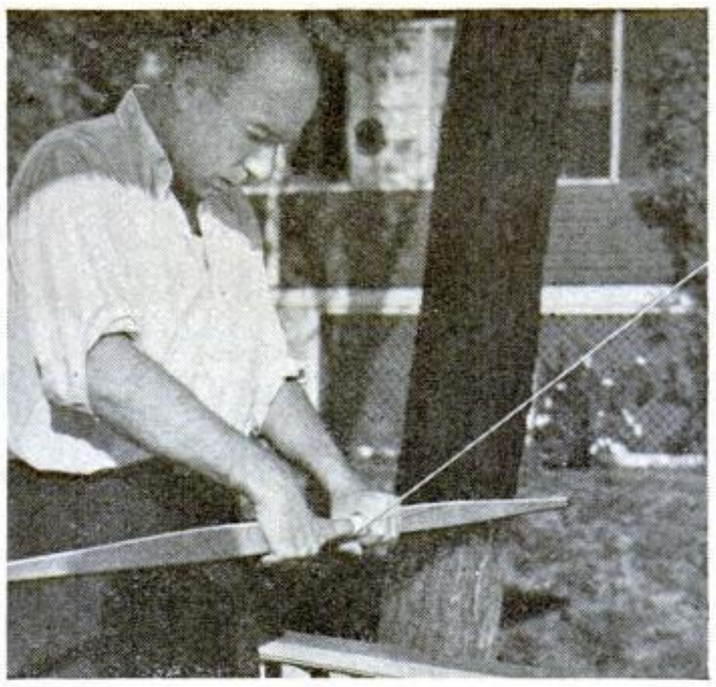


Slight reductions are made with the blade of a penknife or a steel scraper. The wood is first marked with soft pencil so no spots will be overlooked

Especial care and delicacy are required in trimming down the tips or ends of the limbs where the bow is narrow. The best safeguard is to test the bend frequently by using the tiller

THE NEW AMERICAN FLAT BOW

(Continued from page 93)



Wrapping the grip with crab line. The line is clove-hitched to a convenient nail or hook

The bow is now ready to shoot for the first time. Although it is not essential, my own practice in breaking in a new bow is to select arrows considerably heavier than those to be used later. If heavy arrows are available, use them for about 200 shots, as this works the bow down without permitting it to recoil too sharply. Birch hunting arrows ⅜ in. in diameter are about the right weight for this purpose; otherwise use cheap birch target arrows. They can be obtained from archery dealers or sporting goods stores for so little that it hardly pays to attempt to make them. Besides the shooting tab to protect the fingers, an arm guard or "bracer" is needed to prevent the bowstring from bruising the left forearm. The conventional bracer is made of heavy leather, but a piece of fiber or thin, narrow strip of hardwood may be tied on to serve the purpose.

Now tiller the bow again. It will have lost weight and changed shape slightly, and will need further correction.

Glue on a thin piece of white pine to round out the back of the bow. Taper it in gracefully to meet the back of the bow, and round it into the sides. A serviceable grip is made by serving the bow with crab line, chalk line, or braided trolling line. The total length of the grip should be about 4 in., the winding occupying 3¼ in. of this space and the balance being covered by leather circlets. The upper circlet has a projection at the left of the bow; this serves as an arrow plate and prevents arrows from wearing the wood as they leave the bow. Use rather thick leather so it may be whittled away from the underside to a thickness equal to the string binding. The outer edge is trimmed to a feather edge and the ends thinned to make a neat joint; then the leather is dampened, glue coated, and bound in place with narrow strips of cloth until dry. As soon as the leather is dry, shellac the whole handle. The cord may then be painted as suits the bowyer's fancy, and another coat of shellac applied to protect the color.

Plush, velvet, leather, and gimp braid are also used to pad handles, but cord affords a firm grip and is very durable.

Once the new bow has been well tested and has proved itself satisfactory it should be cleaned carefully. Remove all tool marks and thoroughly sand it with the finest garnet paper. Thin some white shellac about fifty percent with alcohol, turn a little on a soft, lintless cotton cloth, and rub the bow briskly until the shellac has dried and a surface begins to show. It will be necessary to work a short section at a time and to go over the whole bow several times to build up a shellac surface. Smooth lightly with very fine paper or steel wool and rub with furniture or piano polish until a dull gloss finish results. This method builds up a surface so thin that it will not crack with bending, yet thoroughly water resistant and beautiful to the eye. A bow carefully waxed and polished after each field day soon takes on a fine luster, and the surface becomes toughened.

If, after a month or so of regular shooting, the bow is found too strong for comfort, it can be reduced to suit and refinished.

So far as the making of various types of arrows, bowstrings, bracers, quivers, targets, and other archery tackle is concerned, there are several excellent handbooks and a variety of booklets that give detailed information.

Keep the bow unbraced when not in use. Hang it from a peg or lay it on a shelf or across a pair of pegs supporting the middle third of the bow. A good bow rack can be made by driving sharp-pointed finishing nails from which the heads have been clipped part way into a plaster wall and slipping over them dowels in which a hole has been bored. The holes in the dowels should be a close fit. If the nails are driven at a slight upward angle and the dowels are cut to fit the wall closely, the effect will be that of wooden pins set in the plaster. If the nails alone were used, the iron would corrode and leave unsightly marks on the bow.

A shelf, too narrow to accumulate other impedimenta and with a raised edge, makes an excellent place to lay a bow. It can be provided with a backboard bearing pegs for hanging other archery supplies.

If you must keep your bow in a steam-heated apartment during the winter, place it in the coolest dry room. Hot, dry heat soon makes a bow brittle. When storing the bow, wrap it from end to end in a strip of woolen cloth, such as an old spiral legging before slipping it into a bow case. It should be inspected from time to time, warmed occasionally, and strung and bent at intervals during the off season. In short, it should have about the same consideration that you give your rifle or your golf equipment.

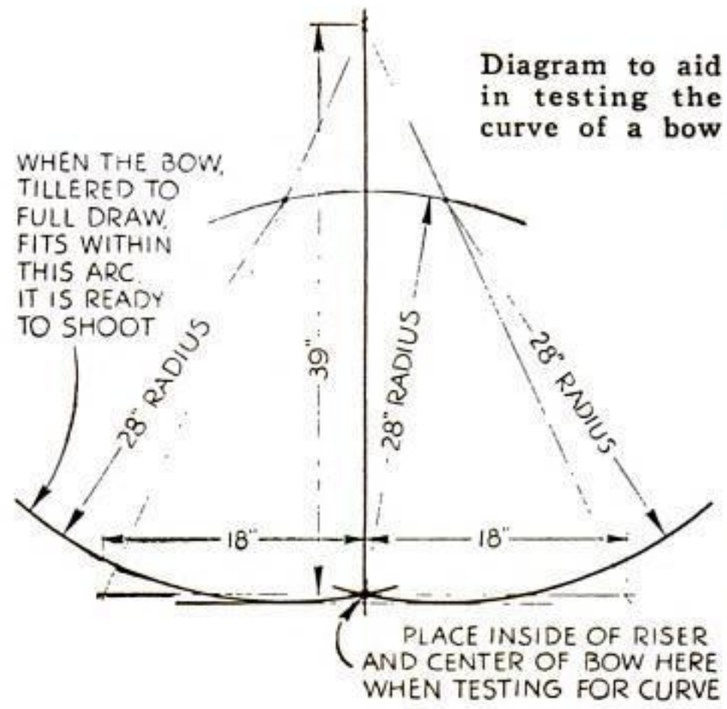
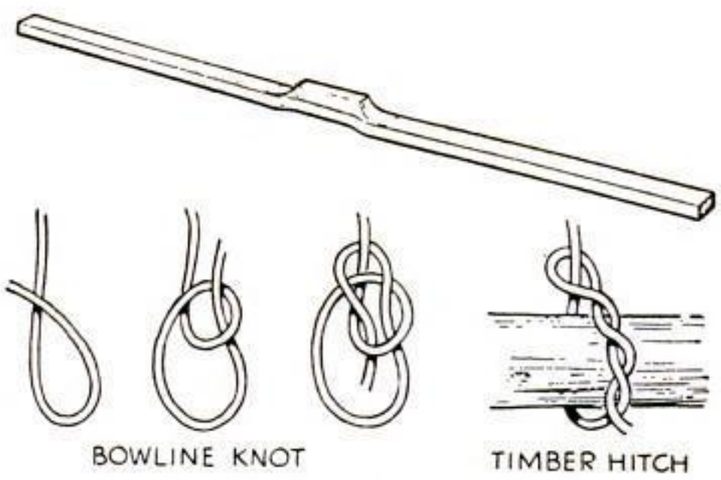


Diagram to aid in testing the curve of a bow



A flat bow stave with handle riser glued on, as purchased from dealer; and the knots used at upper and lower ends of the bowstring

PANELED CABINET AND CUPBOARD DOORS

(Continued from page 91)

side was chosen because of its simplicity.

Cleaning up. The doors are ready, after putting in the dowels, to be cleaned up. Sand all joints flush. If a bench sander is available, it will be found the ideal tool for this part of the work (Fig. 10).

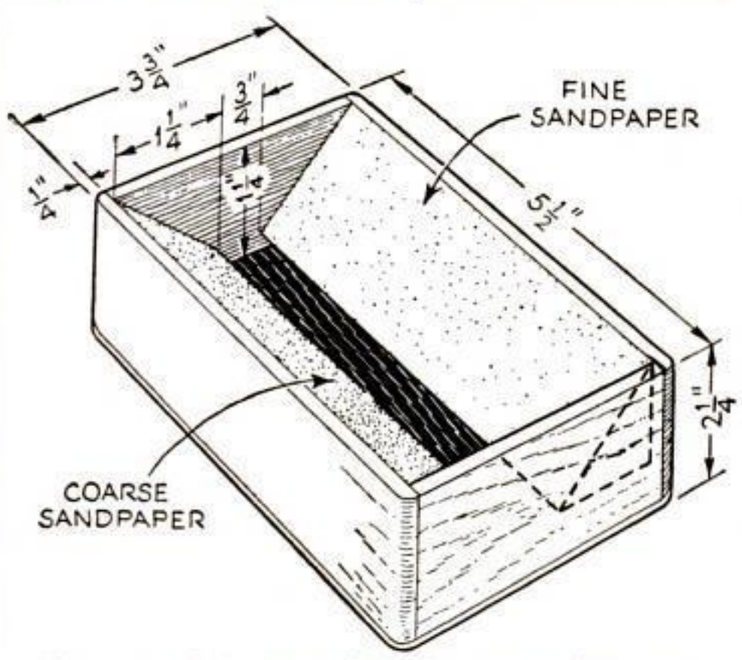
It is often desirable to put in a cross rail or two, either for appearance in a long door, or to enable the use of smaller pieces of paneling. The length of such rails will be the same as the top and bottom rails, the same width as the top one, but grooved on both edges to take the paneling. These rails need not be doweled.

When two doors meet with the type of joint shown in Fig. 11, one stile must be made the width of the lap wider than the adjoining so that both stiles will show the same width on the face side when the doors are hung. In fine cabinetwork, the two meeting stiles should be reduced in width so as to appear as one stile in width; in common work, however, they are better left full width for strength. More durable and sturdier doors may be made by using material 1⅛ rather than ¾ in. thick.

Large sections of wall paneling may be made with an elaboration of this system, which will be found simple, speedy, and economical.

PENCIL-POINTING BOX TRAPS THE POWDER

ORDINARY sandpaper pads used by draftsmen do their work well enough, but the powdered lead must be jarred off, leaving some of it afloat in the air to smudge drawings, and such pads are especially objectionable for art students because of the charcoal dust that is



When drafting pencil points are sharpened on the sandpaper, the dust falls in the box

spread around. The box illustrated is an improvement because it traps most of the dust.

Built of ¼-in. wood, the box is fitted with two sloping shelves made by ripping diagonally a piece of wood 1¼ in. square. The shelves are nailed in so as to leave pockets beneath. Paste fine sandpaper on one slope, and coarser on the other. With care the paper will last a long time.

Let pencil shavings fall into the box. Dust from the leads rubbed on the sandpaper will sift down of itself. If the box is knocked to the floor, it will almost certainly land on the bottom or the sides, in which case the pockets will prevent any spilling of the contents; yet if it is held upside down over the wastebasket and tapped, it can easily be emptied.—E. L.

GRAPHITE HELPS TO PREVENT SCORING TAILSTOCK CENTER

WHITE lead and oil are commonly used to lubricate the tailstock center of a metal-turning lathe. If a small amount of powdered graphite is added, it will help prevent the possibility of a scored or burned center.—W. C.

YOUR MICROSCOPE SHOWS YOU DANCING DRAGONS

(Continued from page 43)

The deadly trichina worm, which causes trichinosis by embedding itself in animal muscle

specimens, transfer them to a five-percent glycerin solution (one part glycerin to nineteen parts distilled water), and set aside until the water evaporates. This process requires usually two or three days but may have to be prolonged several weeks for very delicate specimens. When the water has evaporated, the nemas are in pure glycerin. Finally, mount in pure glycerin or in glycerin jelly.

This jelly, a handy mounting medium for specimens not completely dehydrated, is made as follows: Soak a quantity of dry gelatin in cold water for about thirty minutes, until it becomes soft. Drain off all the water, leaving nothing but the swollen gelatin. Warm this in a double boiler until it melts. Add a small quantity of white of egg (egg albumen) and stir thoroughly. The heating causes the albumen to coagulate into a precipitate that carries away all impurities, leaving the gelatin clear. Filter the gelatin through hot flannel and add an equal volume of glycerin, and about one gram of chloral hydrate for every gram of gelatin used. Mix the ingredients by shaking. Let the jelly stand in a warm place until the bubbles rise and disappear. In mounting, take care to avoid including air bubbles under the cover glass, because they will not work their way out as they do when balsam is used.

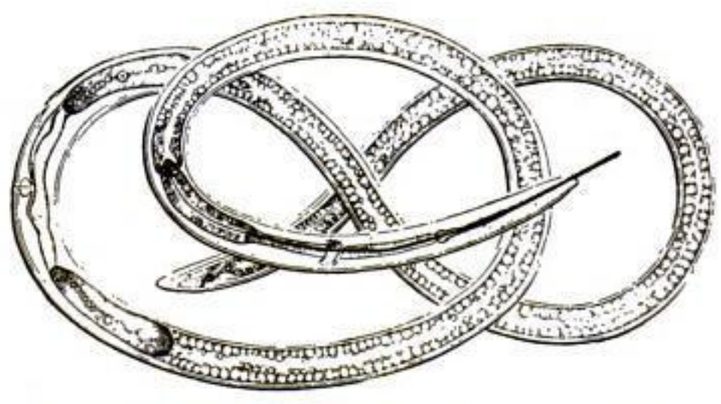
IF GLYCERIN jelly refuses to harden when cooled, it either contains too much water, which can be removed by warming over a water bath, or was heated too much in being melted. In mounting a specimen, warm the jelly to render it fluid, and warm the slide and cover glass to prevent sudden cooling.

A nematode is incased in a tough, transparent layer or "skin" which generally consists of two laminations, the cuticula and subcuticula. Nematodes shed their skins like snakes, so that the under layer later becomes the outer one. Each of the two cuticular layers is, in turn, composed of several other layers, usually three.

Careful observation will reveal that the skin of almost every nematode is marked by fine lines or striations running across the body, at top and bottom, but not traversing the sides. One cause of these crosswise markings is found in the endless whipping of the worm's body in characteristic nematode fashion, and the consequent alternate stretching and compressing of the cuticula.

Sometimes it is possible to separate the skin of a vinegar eel by adding a few drops of absolute alcohol to the drop of water on a slide containing the tiny worm. This causes the internal organs to separate from the incasing walls and shrink into a slender line extending from end to end of the cuticular cylinder, probably by absorbing water from the worm's insides. If a cover glass is dropped over the specimen, and a drop or two or some stain such as Loeffler's methylene blue solution is added to the cover glass edge and allowed to diffuse underneath the glass, the almost invisible cuticular sheath will be brought out plainly, the dye remaining outside it and thus marking the sheath boundaries.

If you find a nematode with a thick, loose skin, you can watch it in the process of molting. During its growth, a nematode sheds its outer covering, and the lining of its mouth, esophagus, and rectum about four times. In species having tiny teeth in the pharynx, two and sometimes three complete sets of teeth can be seen, for these are shed along with the cuticula.



The dagger nematode, as sketched by a nematologist of the Department of Agriculture

The digestive system of the nema includes a mouth that is adapted either to biting or sucking; and the esophagus, intestine, and rectum. There are glands in the mouth to aid digestion. Nemas with movable, muscular lips frequently have toothed gripping organs.

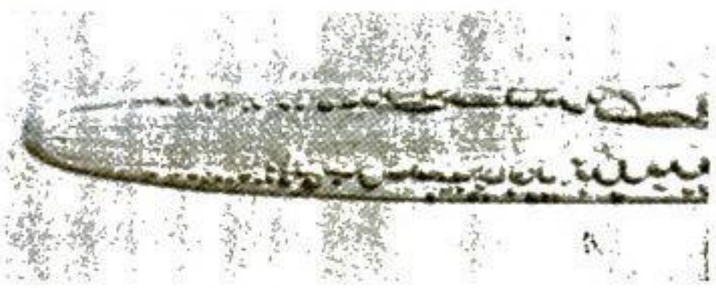
The esophagus is seen in a variety of forms, from a simple tube to a complicated organ having a bulblike swelling useful in exerting powerful sucking forces. The intestine is essentially a long tube, although there is in some specimens the suggestion of a stomach at the front end.

The nematode has no heart-and-artery circulatory system as do higher animals. The body cavity contains a colorless fluid that splashes about irregularly as the body is moved, bathing the organs. Perhaps the constant whipping action of these tiny worms is to their circulatory system what the beating of a heart is to that of larger animals.

ENCIRCLING the esophagus, near the middle of the neck, is a ring-shaped bundle of nerve fibers that form a simple brain. Extending from it to other parts of the body are nerves which control the organs and muscles. Several species have distinct eyes or eye spots, sometimes equipped with tiny lenses which probably act as light collectors rather than image-forming devices. Running back from the eyes to the nerve ring are nerve fibers.

Other important organs visible to the microscopist include the sexual apparatus, hairs or spines which apparently serve as tactile hairs for feeling the way past obstacles, and several items whose use remains a mystery.

Among the most prominent of these mysterious devices are the "lateral organs," two sense organs *(Continued on page 97)*



Head of a vinegar eel, photographed by "relief lighting" from the microscope's mirror

DANCING DRAGONS UNDER THE MICROSCOPE

(Continued from page 96)

situated on the outside of the head, one on either side. The function of these organs is thought to be that of a chemical sense organ. The outer parts of these organs may be in the form of a spiral, circle, helix, or merely a straight projection. They are directly connected with the central nerve organs.

Nematodes cause millions of dollars worth of damage every year and are responsible for a great many deaths. Hookworms, which attach themselves to the intestinal walls and drain the energy of their host, are nematodes. So are the worms that are found in sheep, hogs, and many other domestic animals. The dreaded trichina worm, which by burying itself in the muscles of a pig causes the disease known as trichinosis in the animal, and in humans who eat improperly cooked pork obtained from such a slaughtered pig, is among the most dangerous of nematodes.

MUCH of the research work carried on by Government nematologists is directed towards combating the nemas which attack such useful plants as wheat, sugar beets, and strawberries. The root-knot nema, one of the worst of this class, is known to attack nearly a thousand different plants.

The Nematology Laboratory of the U. S. Department of Agriculture is one of the most unusual and important workshops operated by Uncle Sam's scientists. Here highly trained workers do nothing but study nematodes, make marvelously detailed drawings of them, develop better ways of seeing them with microscopes, work out methods of combating their destructiveness, and even learn how to put some of them to useful work! They have discovered one kind of nema that will attack and devour another nematode whose specialty is damaging citrous-tree roots. There are nemas that kill insect larvae, destroy the eggs of such injurious insects as grasshoppers, and even transmit diseases which kill destructive insects.

In the nematology laboratory at Washington you will not find much photomicrographic activity. No satisfactory method of recording photographically the delicate details of nematodes has been developed, so the nematologists are at the same time expert artists. The making of a complete drawing may require months of work and thousands of observations. Efficient drawing equipment, head-rests that reduce the fatigue of hours of observation, and the best microscopes in the world are used. Still, much of the success depends on downright skill and patience of the observer.

SCIENCE MAY REALIZE ALCHEMIST'S DREAM

ARTIFICIAL production of gold in the laboratory, in quantities sufficient to cause the displacement of this metal as the world's money standard, is a possibility envisioned by Prof. S. C. Lind of the University of Minnesota. Research workers in the field of artificial radioactivity, he states, have been able to change one element into another by bombarding and breaking up atoms. If more efficient means can be discovered, economical production of gold from baser metals will drive the price of the rare metal down to a fraction of its present value, he asserts.

BOYS ARE LEFT-HANDED MORE OFTEN THAN GIRLS

LEFT-HANDEDNESS is more common among boys than girls, according to the report of the city physician who examined over 7,000 schoolchildren in Stuttgart, Germany. Ten percent of the boys were left-handed; only seven percent of the girls.

MORE $5 PRIZE WINNERS

Three prize winning letters in POPULAR SCIENCE MONTHLY'S new Secrets of Success contest—*"What Home Study Has Meant to Me"*—are printed below. Read these stories carefully because your own career may be just as interesting and inspiring to other readers. If you think so, put it down on paper and send it in. We will pay $5 for every letter we publish.

CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

We are interested in facts, not literary ability, but please write clearly, completely, and keep your letter within 750 words. We are not looking for "get-rich-quick" stories or freak adventures, and authors must be prepared to substantiate the truth of the statements. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless sufficient postage is provided for this purpose. Address your contribution to Success Story Department, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, N. Y.

"SATISFIES HABIT OF ASKING QUESTIONS"

Home study is not entirely correspondence school work, although I have taken work that way and still do. A lot of my home study consists of sitting down in my easy chair in the evening with a good book (facts, not fiction) and reading about what is going on in the world . . . literature, science, travel and history.

The correspondence school, however, has opened up a vast field for me that otherwise would be wholly closed and at no time during the past fifteen years have I been without something to study.

Diplomas to date—none. Nor am I ashamed of that. But knowledge—plenty! Some of it has been a help in my business, enabling me to earn more money, but by far the most valuable part of it has been the fun of delving into things about which I knew little or nothing . . . whether there was any money involved or not.

My first attempt at correspondence study was typewriting. I faithfully practiced until I had a good working knowledge of the machine; then found myself so deep in work that I had no time to go further. Yet part of my job required typing and so my home study was useful.

Secrets of Success

Always interested in snapping pictures, I followed photography by mail until new circumstances prevented further study. It was just a hobby, perhaps, but I have often cashed in on it as the result of my study at home.

Even though changes in my own particular situation have prevented the completion of courses of study, I always see to it that I have all the materials of every course on hand. These form a part of my library and a valuable part of it. No matter how foreign at first it may seen to be to the work in which I am engaged, I usually find use for the knowledge gained by home study even though I have come now to consider it a hobby rather than a deliberate attempt to elevate my status in the social or economic world. It satisfies my never-lost boyish habit of asking questions.

—W. F. M., Ballston Spa, N. Y.

RIGHT HAND CRIPPLED AT AGE OF 32

Twenty years ago while working at the carpenter's trade I had a serious accident. Fell off a scaffold through a plate glass window, severed all the arteries and leaders on the front of my wrist and came near bleeding to death. After several weeks in the hospital I came out with my right hand completely helpless.

The carpenter's trade was all I knew, I was 32 years old and there were not any workman's compensation laws in the State at the time. I did get $400 from the union for total disability but with a wife and three children to support the future looked pretty black. However, the State Vocational Department for Rehabilitation was newly organized and reading an account of it in the newspaper, I made up my mind to write and see if the Department could do anything to help me in my difficulties.

The result was that the State paid for and gave me a course with the ——— Schools in building contracting. I studied hard at it, burning the midnight oil many a time until one and two o'clock in the morning. I found that the part in which I was most interested, and to which I took the most readily, was drafting although it was pretty hard for one who had never used his left hand. It was like being educated all over again.

About three-quarters of the way through the course, I got a job as draftsman and detailer with the ——— Lumber Co. I kept on improving and, as I got experience, my salary was being raised. From the financial standpoint, I was doing far better than I had ever done, or expected to do. In five years I was making $75 a week.

When the depression hit the ——— Company in June 1931 and they went out of business, there were two years when I couldn't get any regular work but during the past three years I have been steadily employed, thanks to my home study. Jobs for a trained man are easy to get, especially in my line, for I have been offered no less than eight in the last six months. Not only that, but wages are going back up again; getting near to what they used to be . . . for me, anyway.

—A. J. D., Jacksonville, Fla.

Secrets of Success

PROFITS INDIRECTLY FROM HOME STUDY

It was during my first years of high school that I became interested in taxidermy and entomology. I started to collect specimens of animals and insects about four years ago but found that I ruined or mutilated many of them due to my inexperience.

Realizing that I lacked technique, I searched the local libraries but found little literature of any help. My last resort was to answer an advertisement of the ——— School. From them I learned that for a small sum of money I could obtain a complete course in collecting, mounting and preserving animals along with another course in furcraft. I grasped this opportunity and I have never regretted it.

Now that I have completed the course I do not intend to sell my services as a taxidermist or entomologist. But being a farmer gives me great opportunity to realize indirect profit from this hobby of mine. It is when a strange bug or insect is destroying some crop, when some peculiar worm is feasting on ear corn, or when a little web "house" is found on an orchard tree that the study which I have had is appreciated. When I discover such pests, I cyanide and mount them. Later I classify them and discover means of checking their invasions or getting rid of them entirely.

However, as I master things step by step, I find that there is always more to learn. I am thankful to the Government for publishing an endless number of bulletins dealing with every branch of agriculture and also to farming magazines. These keep me busy during my spare time, devouring helpful hints and kinks which often mean direct savings or profits to me. Last but not least, I am proud to say that POPULAR SCIENCE MONTHLY is as educational to me on the farm as it might be to anybody else at any other trade.

—*H. W. Z., Shawano, Wis.*

BOX CONNECTORS FOR ELECTRIC WORK MADE FROM COUPLINGS

COUPLINGS may be used on steel-tubing electrical jobs if you run out of box connectors and it is inconvenient to replenish your supply. Unscrew one end, remove the "squeeze" collar, and insert the coupling body in the knockout hole in the outlet box or cabinet. Tighten the coupling first with the end part removed. The end of the tubing and inside end of the coupling should be reamed if the edges are sharp. A coupling used in this manner can be tightened more thoroughly than a lock nut on a regular box connector.

WALL BOARD USED IN PLACE OF EXTRA LARGE DRAWING BOARD

NEEDING a large drawing board and not having the time to get one, I obtained a sheet of composition wall board 3 by 5 ft., which came squared quite accurately. After it had served its purpose, I found it useful as a base on which to thumb tack large blueprints for easy examination.—L. N. G.

HAND-TOOLED LEATHER BRACELETS AND PINS

(Continued from page 63)

outside center of the frame with leather cement. Then glue the flesh side of the tooled or toppiece of leather to the outside of the padded frame. The inside piece of leather is then cemented in place. Slip the bracelet over a cylindrical piece of wood and complete punching through the inside piece of leather. Lace all around with a loop stitch. When the lacing is completed, tap the seams lightly with a wood mallet. Stain the edges with India ink and then polish.

The method of tooling, punching, and assembling the bar pin is the same with the exception of the lacing margin, which should be 3/32 in. from the edge for the thong lacing. The materials are: 2 pc. tooling calf 1 by 2⅝ in.; 1 pc. celluloid ⅛ by 11/16 by 2¼ in.; 42 in. of 3/32-in. thong for lacing edges; and 1 pc. 26-gauge copper 11/16 by 2¼ in. Cut the material to shape as illustrated. Parts for the pin assembly may be purchased from a manufacturing jeweler or supply house or taken from some piece of ten-cent jewelry. The size of the pin illustrated is catalogued as 1½ in. in length.

In assembling the pin parts, soft solder the catch and stem to the copper plate, placing them 1½ in. apart, center to center. Fasten the pin to the stem by inserting a small length of wire rod through holes in the stem made for this purpose; then tap on a rivetlike head with small hammer.

When the pin plate is assembled, fasten it to the bottom side of the celluloid with a few drops of acetone; this will fuse the celluloid and cause the plate to stick firmly.

The bottom piece of leather is punched 1½ in., center to center, as shown to fit over the pin stem and catch. Punch for the thong lacing as described for the bracelet, but use a flat board surface instead of a round piece.

MELTED STICK SHELLAC REPAIRS WOODWORK

Stick shellac in a large variety of transparent and opaque colors is sold by dealers in wood-finishing supplies for the purpose of patching cracks, holes, and other blemishes in furniture. The shellac is applied with a hot knife or small soldering iron, very much as if it were sealing wax. After it has hardened, it is trimmed flush with a sharp chisel or knife and sanded perfectly level. The repair often can be detected only by close examination, provided the color matches well.

If the commercial product cannot readily be obtained, a substitute can be made by placing a cupful of powdered or flake shellac in a piece of cloth about 12 in. square, folding and tying the corners, and immersing the bag in a pan of boiling water for about ten minutes. Lift out the bag, drain for a few seconds, and squeeze the shellac into a plastic ball. Then remove it from the cloth and roll it into sticks of convenient size. This forms a tough, hard filling of the natural shellac color. Dry pigments may be added as necessary to the shellac so that it will match the work to be patched.—W. C. C.

CUTLASSES FOR SHIP MODELS

An added touch to a nineteenth century naval ship model is the cutlasses which were usually hung under the poop deck in the break. These can be made of pins or thin wire. Cut them to scale length, bend a loop at one end, flatten one side to represent the guard, and paint.—John Hinternhoff.

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CLEANING UP THE BATTLEFIELDS

(Continued from page 13)

Yet the task of reconstruction stimulated invention and perfection of new and better machinery and appliances, and the determination to rebuild better than ever. The sturdy French peasants returned to the ruins, sought out their old homes; began over again in cellars—in shacks made of corrugated iron from dugouts, or in the dugouts themselves. With splendid energy, in two years they had filled in 134,000,000 cubic meters of trenches and

A liquid-fire thrower, one of the grim souvenirs recovered from the French battlefields

shell holes and reaped a sinister harvest of 182,000,000 meters of barbed wire, virtually reclaiming all of the 10,000,000 acres—on the surface.

That surface had been littered with unexploded shells, hand grenades, cartridges. To pick them up, was risky, but it was done. But, duds got into strange places. A woman used one to prop open a stove door. Another lighted a fire to warm a dugout, and touched off a dud under the floor. Beneath other floors were gas shells left behind by the retreating Germans, with time fuses set, to gas the Allied troops subsequently occupying the dugouts. Those that did not work remained, to be jarred into activity by the returning French peasants. So, in the "red zone," many a man, woman, and child carried a gas mask.

Often a road crossing, bridge, or railroad station would suddenly disappear in flame and smoke, as a forgotten mine blew up. Years after the Armistice, near Douai, workmen were digging beneath a railroad station. Something caught a pick. The laborer started to yank. But a former soldier seized his arm.

"CAREFUL!" he cautioned. "It may be a mine!"

It *was* a mine—enough buried high explosive to have blown the station sky high.

Although, within a few years, most of the "red zone" looked as if it had been cleaned up, danger still lurked beneath the surface. Mostly, dud shells.

What causes duds? Why don't shells explode? Perhaps, because the bursting charge of powder has become damp or deteriorated; perhaps, because the gun had a firing-pin too blunted to ignite the fuse; but probably, because there was something wrong in the fuse, the spark plug of the shell.

How many shells were fired in the World War? In the forty-seven days of the greatest of American battles, the Meuse-Argonne, the cannon of our First Army fired 4,216,575 shells—and there were bombs and bullets besides. In 1918 there were, on the Western Front, twelve major battles and innumerable smaller engagements and bombardments. Perhaps Allies and Germans fired 200,000,000 shells on the Western Front that one year. There were four years of war, and a dozen or more "fronts," great and small.

So, millions upon millions of duds lie scattered on the battle-fields, especially beneath the surface of that "red zone" of France and Belgium. Spring plowing is a dread ordeal for the farmer, who may be blown to pieces as his plow or his horse's hoofs strike a hidden *obus* —French for shell.

In war, it took 400 shells to kill a man. In peace, almost every exploding "dud" kills at least one man, woman, or child.

So discouraged were many peasants that they begged Paris to find new ways to end the menace. Now to clean up the battlefields, there has sprung into being an industry unique in the business world—the *Entreprise de Désobusage;* meaning "Company for Un-shelling Shells." The main office and "plant" of this remarkable concern are in a castle—the ancient and picturesque Chateau of Coucy, near St. Gobain Forest where the Germans hid the long-range guns that shelled Paris. From there is directed the battle for peace waged by 5,000 men scattered through the "red zone."

EACH of them covers a certain area, where every one knows him and his work. He does some searching for duds on his own, but mostly, like a fireman, he awaits the alarm.

At St. Aubin and Heurtebise, where the company maintains its two shell-exploding grounds, there are notable battlefield museums but few tourists see them. They seem to stay away. Here great piles of shells, many still bearing fuses, await the ministrations of sturdy, former French artillerymen in corduroy.

First they inspect the fuse, if necessary, with a microscope, to see whether it can safely be handled at all. If there is any doubt about it, back it goes into a specially-built truck. A workman drives it out to a secluded field. The whole surface is pockmarked with shell craters. To the metal shell fuse he attaches another of the type that miners use. It is long enough so that he can light it and have time to get into an underground dugout before the explosion.

Near that blasted field is a wood in which the trees and underbrush are wilted, blighted. Here gas bombs are taken. Workmen who handle them, put on gas masks and, wearing gloves, daringly let out the gas—but only when the wind is blowing strongly enough to take it away from them. The empty bomb is sold for junk.

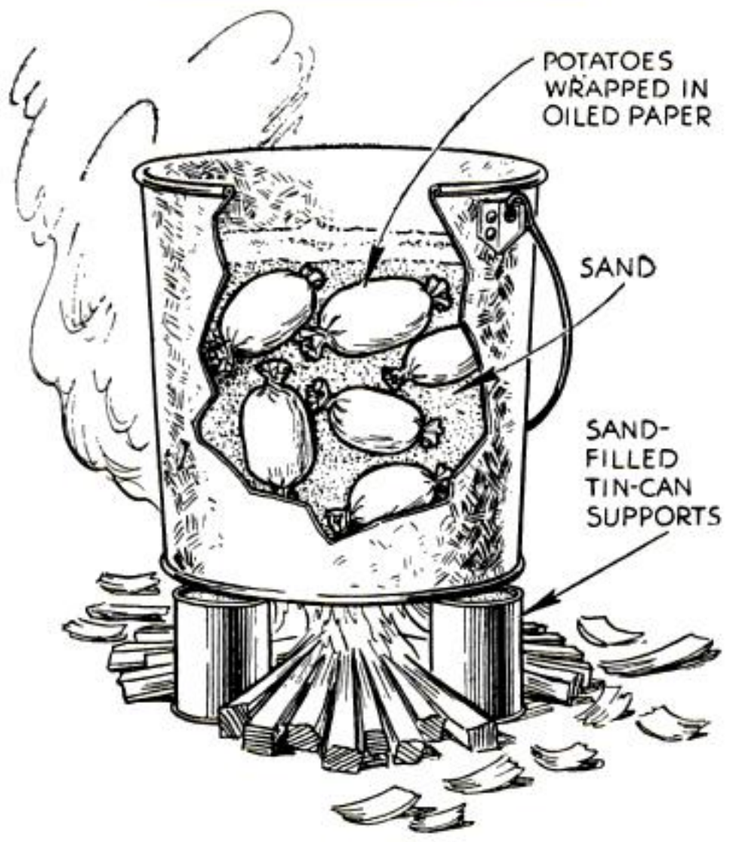
SO ARE empty shells, if they can safely be emptied. If the expert's trained eye determines that he can remove the fuse without blowing himself to Kingdom Come, he puts the shell in a vise equipped with a hand-operated wheel, and removes it—usually by unscrewing it. Without its "spark plug," the shell is harmless. Through the hole where the fuse was, other workmen pour out the powder of the charge. The French Government gets that, tests it, puts it into new shells. The shell cases and other metal belong to the company, which has gathered from the battlefields and sold the amazing total of a million pounds of copper and lead, and seven million tons of iron and steel. In the last six years, the experts have destroyed 167,000 tons of duds, but have brought in 1,500,000 tons and still have left, undestroyed, 350,000 tons. To gather that deadliest junk pile on earth, 5,000 men have risked death driving 350,000 miles.

They are about the most careful truck drivers on earth. Two years ago, one had an accident. Loaded with cylindrical death, his truck upset. A great sheet of flame, a frightful crash, a rending roar. The truck flew to flinders; every window in four villages was broken; a crater forty feet deep was dug. At the bottom was the driver. As rescuers arrived, he arose, and dusted off his corduroys.

In all these years, not one man employed in cleaning up the battlefield has been killed!

STUNTS FOR CAMP COOKS

(Continued from page 65)



Potatoes are easily baked in a pail of sand

stunt on yams, tomatoes, apples, and eggs, to say nothing of cased sausages, pork chops, and fish. Meat should be seasoned and wrapped in two separate layers of paper. Split the fish and put a slice of bacon in the cut before wrapping.

Now suppose they want stew or bean soup for dinner. Good stuff all right, but it usually takes a lot of fire feeding and watching. Here's how you can beat *that* racket. Build your fire down in a hole dug 18 in. deep. Sling the kettle over the hole and after your fire is going good, slant thick sticks of fuel on end all around the sides of the hole, as shown in one of the drawings. Use more green wood than dry so the sticks feed down slowly on the coals as needed. This fire will burn for at least three hours. Be sure before you leave that the food in the pot is well covered with water.

Here's a stunt for green-corn time that started back in the bushwhacking days of the Civil War, but it tastes just as good today as then. Twist an ear out of its cover of husks and insert a cleaned, seasoned fish. Tie up the ends of the husks and bury in the hot ashes of your fire. In forty minutes you'll have a steam-cooked flaky dish that makes you wish stomachs were twice as big.

If you camp for a week in one place, by all means make a bean hole. Then you can serve beans like nobody's mother ever did unless she had a bean hole too. Dig the bean hole in dry, solid earth. Make it just a little larger than your pot. Build a fire in the hole. Now here's the secret of this bean-hole business: You must keep that preheating fire going for at least four hours! You've got to heat the ground surrounding the hole and heat it well.

For four men use 2 lb. or 5 cups of beans. Soak them over night, parboil with a little soda, and drain. Add:

1 large bottle catsup
1 lb. bacon
1 onion cut fine
¼ lb. brown sugar
1 teaspoonful salt
1 teaspoonful mustard
Enough water to stand 1½ in. above the beans

If the potlid doesn't fit tight or if the beans were not well soaked, double the amount of water. Empty the hole, set in the pot, and pack ashes around and over it. Cover with earth, heaping it 2 ft. high over the top of the hole. A piece of canvas spread directly over the potlid makes it easier to uncover.

Leave the beans in that hole for twelve or fourteen hours—longer won't hurt. Camp cooks often pack the hole in the evening so the beans are ready for the following noon.

NAME YOUR NOISE

(Continued from page 19)

the record. Occasionally, three or more of these sound cabinets will be operated simultaneously to obtain specially complicated background effects.

It is hard to think of a grunt, growl, whine, squeak, roar, murmur, whisper, or crash that the sound libraries can't pull out of their record files. Just name your noise. Traffic sounds at Times Square in New York City; a racing car roaring along a speedway; a 1910 auto chugging uphill in low gear; balls rolling down a bowling alley and crashing into the pins; a man chopping ice; two men chopping ice; 2,000 canary birds singing at once; a man crunching along over frozen ground.

EACH record usually contains about four or five separate "cuts" or sections. Thus a barking-dog record available at one library includes: English bulldog barking (thirty seconds); collie pups yipping (ninety seconds); chow pups whining (thirty seconds); and thirty excited dogs of many breeds barking all at once (thirty seconds).

If you hear a baby crying pathetically offstage at a theater, or during a radio play, the chances are it is no imitation but an unhappy infant recorded while it was being pulled through an attack of colic. The gales of infectious laughter on one record were started by a sound engineer's joke; that number is sometimes played for advertising purposes in the lobby of a theater showing a comedy.

Thomas J. Valentino, supervisor for one of the large record-making concerns, fills special orders for new plays that open on Broadway. For the offstage noises of one show, he made special records of express-train noises, including the sounds of starting, stopping, applying brakes, blowing the whistle, crossing bridges, and switches, passing another train, and blowing off steam. These were made with portable sound equipment mounted on a flat car coupled to a regular train.

One much-used disk has saved a great deal of dishes, bowls, and chinaware. The sound of smashing china can only be reproduced realistically by actually smashing china. Heretofore, when scripts called for crockery crashing, property men bought a supply of cheap chinaware and broke it in front of the microphone. Now, they merely turn on a record.

In spite of the amazing variety and number of sound effects available on records, it is still impossible to get one of a mouse squeaking or a whale spouting. The alarming rumble of a real earthquake has not yet been impressed on wax, but many other natural uproars have been recorded. The eruption of a volcano was registered when daring sound-effects men held a microphone over the edge of a crater, and other operators have braved floods and rapids to put their distinctive sounds on disks.

PERHAPS the most important contribution of the sound library is its work in storing up a vast file of audible current history. The voices of most of the prominent world figures of today are constantly being recorded on the sound films of the newsreels. These films are transferred to the more enduring form, the acetate or wax disk. Even when the actual voice of a personage is lacking, there has probably been a very accurate imitation made and recorded.

How famous persons of the pre-phonograph days actually spoke can only be described verbally. Records go back only to the day when Thomas A. Edison recited "Mary had a little lamb" into his newly invented talking machine.

Not long ago, a prize discovery was made of a forgotten, dust-covered cylinder on which was impressed the voice of Queen Victoria, great-grandmother of the present King of England. Although the record seemed almost worthless because of age and hard usage, sound engineers, handling it with the care bestowed on a newborn quintuplet, played it in front of the microphone of a modern sound-recording machine.

When the voice had been transferred to a sturdy wax platter, the engineers began to filter out all the extraneous squeaks and scratches. Each time they recorded the voice, a few of the annoying noises would be strained out of the record. Finally they succeeded in making the disk comparatively clear and audible; thus the voice of England's great queen will be preserved for the ears of future generations.

A SIMILAR procedure was used to restore old records of the voices of Florence Nightingale, William E. Gladstone, Elizabeth Barrett Browning, Benjamin Disraeli, and P. T. Barnum. Just a few years before his death, William Jennings Bryan repeated his famous "Cross of Gold" speech before the sound recorder.

Historic sounds, as well as historic voices, are being impressed in wax. In a few years no one may remember the typical sounds of the old-fashioned village blacksmith shop. Thanks to the sound libraries, however, they are all safely stored away on disks—the hiss of the bellows, the clang of hammer on anvil, the clatter of horses' hoofs over the floor.

Because many experts believe that modern street noises will be unknown in the cities of the future, records of typical street and sidewalk sounds were recently sealed into the cornerstone of a new building being erected in New York City. With light, portable sound apparatus, engineers made recordings of honking horns, squeaking brakes, police whistles, autos backfiring, newsboys shouting, and other familiar sounds of urban thoroughfares. The noises were transferred to chromium-plated copper disks, coated with an imperishable tarry compound, and locked in a copper box. Included along with the disks were a phonograph pick-up and complete instructions for removing the tarry coating and for playing the records. These instructions were indelibly etched into panes of glass with hydrofluoric acid.

The producers of a radio drama of the Civil War persuaded a group of Confederate veterans to record their celebrated "rebel yell," a shrill battle cry used by charging troops. Historians are as grateful for that recording as are music lovers for the preservation of the golden voice of Caruso.

Columbia University is building up an extensive file of records of the various dialects spoken all over the United States. These disks provide a collection of data invaluable to the ethnologist, the novelist, the playwright, and the actor.

IN ADDITION to their miscellaneous sound-effects records, the large broadcasting chains are accumulating libraries of contemporary historical events as recorded on disks. The funeral ceremonies and memorial services for the late King George V fills a set of twenty-seven records, some of them on sixteen-inch disks which play for half an hour at a time.

So science is saving our sounds. More and stranger noises are being recorded on wax than were dreamed of when the phonograph was first invented. It may be a historic voice, broadcast from half way across the world; it may be anything from a baby to a battle, from a rare bird to a rattlesnake, from traffic tumult to legal testimony. Historians of the future will not only "look at the record," but listen to it as well.

HOME EXPERIMENTS IN ORGANIC CHEMISTRY

(Continued from page 49)

than a plain glass tube; this should be at least half an inch in diameter, so that drops of condensing liquid will not be spurted out of its top by the pressure within the flask. An air-cooled condenser of this type is less efficient, however, than a water-cooled one.

Vinegar may be substituted for pure acetic acid in making lead acetate by the method just described, since it is a dilute solution (about five percent) of acetic acid, together with other substances. Glacial acetic acid is 100 percent pure, containing no water; in other words, a thirty percent solution of this chemical in water will be a thirty percent solution of acetic acid. No matter what proportions you use, you can always prove that the liquid obtained in the experiment contains lead by adding several drops of strong sulphuric or hydrochloric acid. A white precipitate consisting of lead sulphate, or of lead chloride, depending on which acid is used, will form if lead is present.

IN REFLUXING operations such as these, you will find that a round-bottomed flask withstands "bumping," or violent boiling, better than a flat-bottomed one.

A recent article of this series told how giant forms of the fireworks novelty known as "Pharaoh's serpents" could be made from an organic chemical called paranitroacetanilide (P.S.M., Apr. '36, p. 50). This chemical, a fluffy yellow powder, is commercially obtainable only from a chemical supply house. You can prepare it yourself, however, from acetanilide, which you can buy at a drug store.

Place about thirty cubic centimeters of strong sulphuric acid in a flask with a capacity of approximately 150 cubic centimeters. Cool the acid by immersing the flask in ice water. Then add about fourteen grams of acetanilide, a little at a time, still keeping the flask chilled. A convenient way to do this is to attach a "sinker" of sheet lead, as shown in an accompanying diagram, so that the flask will stay immersed and remain upright.

Now add fifteen cubic centimeters of nitric acid, drop by drop. This operation is called "nitration," and converts the acetanilide into the "nitro" compound. Meanwhile, the sulphuric acid combines with water that is released in the reaction, so that the nitrating process will not be slowed down by dilution. Do not let the temperature of the liquid rise above twenty degrees centigrade.

When all the nitric acid has been added, let the flask stand in water for, say, fifteen minutes. Then pour the entire contents of the flask into about a quart of ice water, and stir. The precipitate that forms is the paranitroacetanilide.

USING a piece of cloth in a funnel as the filtering medium, filter off this precipitate. Wash it with ice water while it is still on the filter cloth. Then squeeze the cloth gently to remove excess moisture, taking care not to lose an undue quantity of the precipitate by forcing it through the cloth. The cake of chemical may then be dried in the air and bottled for later use. As readers of the previous article will recall, the "snake" experiment is performed by working this substance into a thick paste with strong sulphuric acid, and heating the mixture in an evaporating dish over a small flame. When the reaction sets in, a writhing mass of ash resembling a giant serpent issues from the dish.

Organic chemicals, especially those made in the home laboratory, are best kept in glass-stoppered bottles. Rubber stoppers are unsuitable for bottling organic substances, and for assembling apparatus for experiments with them. Many of these chemicals attack rubber and become contaminated as a result.

HOMEMADE STROBOSCOPE

(Continued from page 47)

"outlet vent" in the side of the housing, as shown, so that the air will clear out rapidly after impelling the vanes. Now it only remains to solder on a flat-headed wood screw to the edge of the polishing-box housing, and screw it into the wooden file handle. This completes your stroboscope, and it is ready for use. A drop or two of oil in the tube bearing will make it spin more freely. A scratch made across the joint of the tin housing when the two viewing holes are in line, with the disk removed, enables you to get the holes in line easily in assembling the device with the disk in place.

JUST a word about the rubber atomizer bulb which furnishes the motive power. It should be fairly large, and must be provided with a one-way valve. Any drug store should be able to supply you with the bulb alone, or with a cheap throat-spray atomizer from which it can be temporarily removed for your experiment.

Further details of construction can be gleaned from the scale plan and photographs. The exact sizes given are not important, with the exception of the width of the slits. These should not be over one-thirty-second of an inch. Wider slits will give less sharp images. I cut each slit by drilling a row of holes in the disk and then filing them into a continuous slit.

The construction given calls for the simplest materials possible. If you have a metal-turning lathe, and some skill as a mechanic, you can construct a much more workmanlike job than the one specified.

With this simple apparatus, you will find it easy to "stop" mechanisms of any moderate speeds. You can, for example, arrest the up-and-down motion of the poppet valve on a gasoline engine, and see it motionless. Or you can "stop" the vibrating motion of the hammer on a door bell.

In fact, having a disk with four slits will enable you to exceed the speed of the electric fan sufficiently to see more than two horse pictures on the circular card attached to it, as shown in the illustration.

Interesting variations on the horse picture can also be tried. Some of these are illustrated, and can be reproduced in larger size and attached to the fan blades.

One of these has three concentric circles of black spots. The inner circle has three dots, equally spaced; the middle one has four spots, and the outer has six. When attached to the fan blades and viewed through the rotating disk of the stroboscope, one of these circles of dots will be seen to spin in one direction, while the others spin the opposite way. An increase or decrease in the disk's speed will reverse the direction of motion, or make one circle stop while the others are still moving. Greatly increased speed will multiply the number of all the spots.

ANOTHER fascinating experiment can also be tried with a circular card on which colored areas are substituted for the concentric circles of dots. In this case, each of the circles of blended color produced by rotating the card can be slowed down and "split" into the primary colors from which it is combined.

If a simple geometric design is drawn upon one of the circular cards, it can be made to change its form and produce differently shaped figures. These shapes melt from one into the other as the speed of the stroboscope's disk varies.

Another interesting subject for viewing through your stop-motion device is an electric bell with one end of a rubber band attached to the hammer, and the other end to a nail. When the bell hammer is put in motion, the rubber band is thrown into a spindle-shaped figure, as shown in one of the illustrations. Now view the rubber band through your stroboscope. When the slits pass the peep hole at the same frequency as the hammer's vibrations, the band can be stopped in a "still" curve. This curve will shift from the left to the right side of the spindle as the speed of the disk varies slightly. A longer rubber band will vibrate in two spindle shapes, which the stroboscope "freezes" into an S-shaped curve.

If you can obtain a small neon lamp of the plate type shown in one of the photographs, you can separate and actually see the impulses of ordinary alternating current! This is possible because only one of the plates of the lamp is glowing at a time, while the other plate is totally dark. With ordinary sixty-cycle current, this gives 120 flashes of light a second, which the persistence of vision fuses into continuous light. When you look at the lamp through the stroboscope, you can speed the disk up until one of the plates seems to glow all the time, while the other is dark. This, incidentally, enables you to measure the speed of your disk. If three of the four slits are covered with bits of adhesive tape, leaving only one open, the disk must be rotating sixty times a second when one plate of the lamp remains dark.

THE alternate dark and light flashes of a neon lamp running on alternating current is, in fact, the basis of an entirely different kind of stroboscope. You can prove this by spinning a top with a row of black spots pasted around it, and then watching it slow down in the light of a flashing neon lamp. For success in this experiment, there should be no other light present in the room.

When the top slows down to exactly 120 revolutions a second, you will be able to see it momentarily motionless, for the flashes from the lamp, coming at the same rate, give you glimpses of the black spots always at the same points in their revolution. The spots accordingly appear motionless, just as they would through the slits of the rotating disk of your compressed-air stroboscope. The successive glimpses you get are given by the light flashes instead of slits; that is the only difference.

Any motion occurring at regular intervals, either circular or vibratory, is an interesting subject upon which to try out your stop-motion device. Try it with the waves formed on water when a faucet drips rapidly into it. Try it on the wheels of cars passing in the street.

You will be able to "stop" the spokes and then make the wheels reverse their direction, just as you have seen them do in moving pictures. This shows that the moving-picture camera is itself a sort of stroboscope.

TESTS SHOW ECONOMY OF WASHING WINDOWS

SELECTED windows in British government buildings have gone unwashed, experimenters recently revealed, while they measured the loss of daylight caused by this neglect. They found a decrease in illumination of eight percent after one month, and of as much as fifty percent in two years. Regular window washing is not only desirable for appearance's sake and good working conditions, their tests indicate, but may result in substantial economies in electric-light bills.

MARRIAGE AIDS HEALTH

STATISTICAL figures compiled by a life insurance company indicate that married men and women are healthier and live longer than bachelors or spinsters. The relatively staid and regular course of married life, it is said, is more conducive to health than the comparatively free-and-easy living habits of single persons.

FORGING NEW WEAPONS FOR THE WAR ON CRIME

(Continued from page 11)

situation, which probably will be duplicated many times in future months: A radio patrol car in, say, Minneapolis overtakes a speeding sedan with Missouri license plates. In it are three men with rifles. Bloodstains are found on the rear seat. Are the men gangsters—or just hunters, as they say?

From the Minneapolis headquarters a radio message flashes to Kansas City and St. Louis. A few minutes later, replies come from the Missouri cities. The men are fugitives from justice and their arrest is wanted urgently. Without the rapid-fire radio link between the cities, these dangerous criminals might have gone free.

An additional step forward in this realm of police work will be the wide adoption of two-way radio sets in cruising patrol cars. They will enable officers to communicate with headquarters and check up on suspicious characters without even taking them to the police station.

PROBABLY the most curious of recent discoveries in criminology is that reported by two Chicago scientists, Dr. Franz Alexander and Dr. Leon J. Saul. After several years of research, during which they studied the breathing of nearly 300 subjects, they have announced that we can be identified by the way we breathe as well as by our fingerprints!

Not only does the breathing "pattern" of one individual differ from that of another, but he appears to keep the same characteristics from year to year. The researches of these Chicago experimenters give the scientific detective one more clew to hidden identity.

Even more amazing is a delicate test reported by an eastern microchemist. It promises to outwit even the most cunning attempts to forge fingerprints by means of rubber stamps or rubber gloves. All the expert has to do is analyze a suspected fingerprint with special reagents applied through capillary tubes under a microscope. This test will reveal the infinitesimal traces of rubber left by the pressure of the stamp or glove!

In connection with fingerprinting, a recent news item reported that 1,000,000 Boy Scouts were filing their prints with the Federal Bureau of Investigation, at Washington, D. C. It is hoped that eventually every person in the United States will have his prints on record. Such a file would prove of great assistance in cases of kidnaping, loss of memory, or mistaken identity.

A few weeks ago, the Department of Justice flashed word to police all over the country requesting that any suspect with mutilated fingerprints be held for careful examination. Attempts by "public enemies" to outwit the authorities by searing away fingerprints with acid or hot irons have been reported from time to time. But the ruse always fails. The mutilation in itself confirms suspicion. And, the 1936 detective has at his command, besides fingerprints, identification clews undreamed of a generation ago.

A dramatic feature of the last decade has been the race between science and crime.

HOW far and how fast the many-sided advance of the crime-detection laboratory has gone was seen not long ago in Philadelphia, Pa. At the Franklin Institute, a series of demonstrations that lasted for eighteen weeks revealed to the public the sensational tests which obtain clews from dust and wood, from ink and paper, from bullets and blood. It showed thousands of fascinated spectators the part microscopes and radio and photography play in apprehending criminals. But, most of all, it dramatized the amazing variety of the tools which aid the present-day scientific sleuth to cope with crime.

CAN YOU AFFORD A NEW CAR?

(Continued from page 54)

more important than anything else on the car—except the steering gear—from the safety standpoint. It's hard to estimate how long brakes will last, so much depends on the driver. On the average, a set of linings will last about 15,000 miles. That means you'd have to have about thirteen relining jobs done in 200,000 miles, and along toward the end there'd be extra charges. The brake drums would have to be refaced, and so on. A fair guess on the total cost of that much work on a car wouldn't be far from $600."

"That's a lot of jack, isn't it?" Russell admitted. "Still, it's spread over seven years and a new car costs $750 all at once, or within a year or so if you take it on time payments."

"WAIT a minute," said Joe. "There's a whole raft of items I haven't included. There'd be generator trouble, wear and breakdown in the ignition and lighting systems, clutch and pilot-bearing trouble, starter-motor repairs, leaky radiator connections, water-pump renewals, carburetor and transmission troubles, and nobody knows how many little things that almost never happen to a car the first year or two. It's a pretty safe bet that they'd run the total up at least another $100."

"But what's a hundred bucks spread over seven years?" Russell countered.

"Just a hundred bucks," Joe smiled. "Which brings the total for the seven years to at least $700. And that estimate is on the low side.

"Now here's how it works out. It costs you $100 a year for depreciation and an average of another $100 a year for upkeep, or $200 a year. At today's trade-in prices, a year-old car in this price class and $200, more or less, will get you a brand-new car of the same make and model. So, for just what you are actually paying now, plus, at most, the price of a set of tires, one brake-relining job, and the few minor repairs that a new car may need for the first 25,000 miles, you can have a new car every year. Isn't it worth it?"

"By George!" Russell exclaimed. "I never looked at it that way. So I can have a new car all the time for something less than fifty berries a year more than I'm paying out now? I'll say it's worth it, even if only to get rid of worrying about what's going to break down next on the old bus. And a nice-looking car is a business asset, the same as a new suit of clothes. I'll be jiggered if I don't trade in the old crock as soon as I get home from this trip, and after that I'll try your plan."

"Humph!" grunted Jones, who had been listening to Joe with interest. "Trading every year like that may be all right for Jim. He covers a lot of miles every year. But it certainly doesn't apply to me, Joe. It takes me three years, or more, to drive as many miles as Jim does in one year. I'd lose my shirt trading every year."

"IT ALL depends on how you look at it," Joe argued, "and how much value you set on having a new car. If you kept it seven years, same as you did the last one, it would cost you just about as much as it would Russell for depreciation—$100 a year—but, of course, you'd have a lot less expense to keep it running. At 7,000 miles a year you'd only cover 49,000 miles in that time. You could probably get by with one ring job, two new sets of tires—tires go bad with age as well as with wear—and a couple of brake-relining jobs. Batteries go bad from age, mostly, so you'd have nearly as many batteries to buy as Russell. Altogether, it probably would cost you between $150 and $200—say, $175, or twenty-five dollars a year for upkeep. This, added to the annual cost of depreciation, would give a yearly total of $125 for maintaining the old bus."

"I'd be a dumb-bell to trade every year on that basis," Jones maintained.

"It would cost you seventy-five dollars a year more than what you paid annually on your last car, or only about twenty-five to thirty dollars more than it will cost Russell," Joe said, glancing at his figures.

"But the answer in your case," he went on, "is to trade every *two* years. A two-year-old car of your make will trade in today at within $250 to $300 of the delivered price of a new car. You drive carefully. You keep your car in fine shape, and your yearly mileage is small, so you'd probably get the top trade-in price, which would make the depreciation work out to not much over $125 a year. So, if you trade in every two years, it will cost you just what you would spend on the seven-year basis, plus the upkeep for two years. You might have to get a new battery before the end of the second year, and you might have hard luck with one tire, but the brakes would last that long. So chances are it would only cost you around ten dollars more a year than you now pay, and you get a brand-new car every two years. Isn't it worth that?"

"IT WOULD be worth twice that not to have to go through all the domestic arguments I've had on the new-car subject," Jones agreed. "But you haven't said anything about gasoline and oil expense. Shouldn't you take them into account? To hear some fellows talk, you'd think the cost of keeping a car is mostly gas and oil expense."

"There's a lot of things besides gas and oil I haven't considered," Joe replied. "But practically all of them cost the same for an old car as for a new one. It costs just as much, for example, to have a dent rolled out of a fender of an old car as it does for a new one."

"You use about the same amount of gas and oil for each mile, no matter whether you have a new car or an old one—provided you keep the old car in good shape," Gus cut in, as he finished tightening the brakes. "Of course, if you keep on using a car after the rings get to leaking and she starts to pump oil, you lose more than the cost of the repairs in the extra gas and oil you have to buy."

"Makes quite a difference," said Joe, his pencil busily scratching. "In your case, Russell, if your gasoline mileage fell off from eighteen to fifteen to the gallon, it would cost you nearly fifty dollars more a year for gas to drive the miles you cover."

"Or somewhere in the neighborhood of thirteen dollars in my case, eh?" Jones broke in. "Well, Jim, guess we better be getting back to the store. Maybe I'll give you a bigger order than I intended to, after what Joe has told me about the cost of the new car. What I can't see, Gus, being as how you're in the repair business, why don't you urge people to keep their old cars and get 'em repaired here?"

Gus grinned. "Why should I, Larry? If you trade in your car and buy a new one, somebody'll buy your old car and then maybe I'll have two customers instead of one!"

PNEUMATIC HAMMERS RID TREES OF INSECTS

VIBRATING trees with pneumatic riveting hammers is the method proposed by a California inventor to rid orchards of insect pests. When a riveting machine is held against a tree trunk, it is claimed, the vibration jars the insects loose from limbs, leaves, and fruit, so that they can be washed to the ground with a strong spray of water. A disk-shaped striking plate prevents the hammer, while vibrating, from bruising the trees.

SAFE LIGHTING DRIVES DEATH OFF THE HIGHWAY

(Continued from page 21)

kind of light source as with another. Sodium-vapor lamps, noted for their distinctly one-color light which enables the eye to see fine details easily, seem to have a slight advantage for lighting very wide road surfaces, because of their inherently wide distribution of light. However, for narrow roads, incandescent lamps with concentrated filaments are more easily directed.

Glare, from improperly designed roadway-lighting units, was found to cause the waste of as much as fifty percent of the illumination. Then, added to this, there frequently is the glare from approaching automobile headlights. Besides distracting the driver, glare actually impairs his ability to see. You have noticed this, no doubt, when passing another car with bright headlights. Haven't you often wished that your own lights were a hundred times more powerful, so that they could bore through the blank wall of glare and reveal the roadway? When glare is present, much additional, properly directed light is necessary to overcome and supplant this blinding condition with a clear field of vision.

THE discoveries made with the model roadway have been embodied in a remarkable new highway-lighting unit whose chief feature is a reflector of novel design. It looks somewhat like an inverted racing-yacht hull that someone tried to fold up like an opera hat, creating a lot of seemingly meaningless ridges. These ridges, however, are scientifically placed to produce reflecting surfaces which, combined, serve to spread the light on the roadway just where it is wanted. This reflector can be used on standard poles, spaced at 125 feet; and it will produce really adequate illumination for safety without materially increasing the total number of lamps nor the electric power consumed in a mile of the highway lighting.

The lighting system, already installed on an experimental highway a mile long, is arranged so that there is little glare. The design of the boat-shaped reflectors confines rays from the lamps to zones ten degrees or more below the horizontal. All the bright lamp filaments, except the nearest one, are thus shielded by the reflectors from the eyes of a motorist; the nearest lamp is shielded by the car top or, in a car with a sloping windshield, by lowering the inside sun visor an inch or two. Thanks to the new reflectors, more than twice as much light reaches the pavement as with former systems. One part of the road receives practically the same intensity of illumination useful to the motorist as any other part in the lighted zone, which eliminates blind spots and makes it easier to see objects in the roadway.

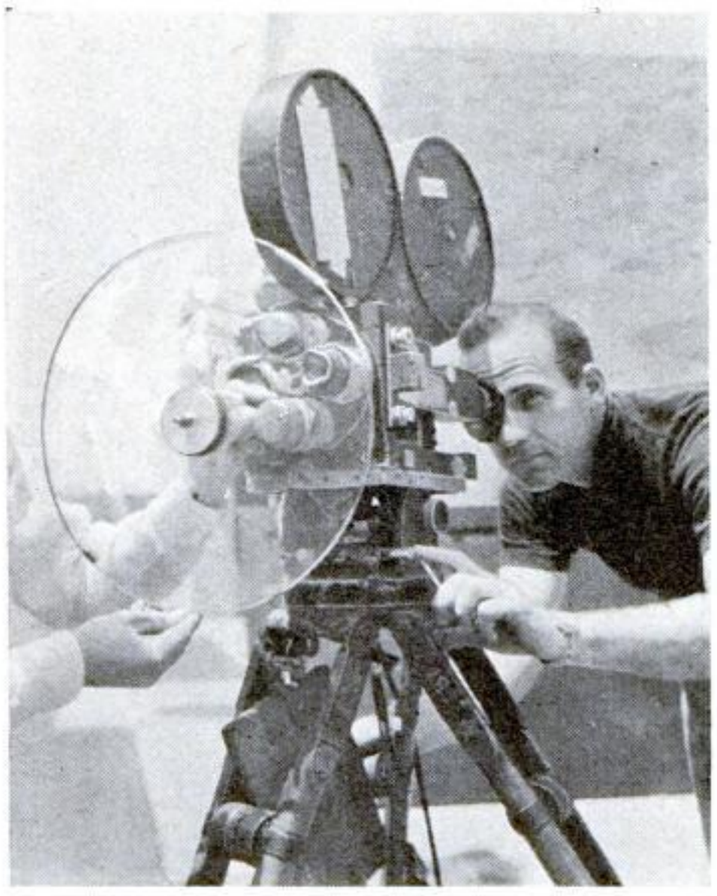
To turn the country's 50,000 most dangerous miles into the 50,000 safest nighttime miles would cost, it has been estimated, $125,000,000 to $150,000,000 for equipment, this being about six percent of the cost of the highways themselves. Then, to operate the lighting systems would cost another $30,000,000 to $50,000,000 a year.

ALTHOUGH this may seem high, figures show that the price of good highway lighting, on the basis of accidents prevented, is far below that of many other safety programs. In 1934, there were 151 grade-crossing accidents within New York State. To eliminate all grade crossings, the state recently authorized a bond issue that will cost $12,000,000 a year in interest and amortization charges. If the same amount were spent each year to light the main highways, at least 10,000 serious accidents would be prevented. And the cost of preventing each of these accidents would be only $1,200.

MOVIE CAMERA WIZARDS

(Continued from page 24)

frosted to reproduce images. A hundred feet beyond the screen is a projection machine staring directly toward the camera. When ready for action, the motors driving the projection machine and the camera are synchronized, and the action starts. The actor and actress remain virtually stationary as they walk on a treadmill, and the foreign scenery, rented from a newsreel company, appears exactly as though they were on a country lane in Finland.



Wavy lines in this revolving glass disk create the "goofy" effects seen in many modern movies

But the effect of a Hollywood actor looking on a foreign scene is not always so simple. The other day, while filming "Mary, Queen of Scotland," the trick photographer on the picture was asked to arrange for an actor to be shown in the foreground while a castle in the distance was destroyed by a terrific explosion. After some experimentation, he had a sheet of glass painted to represent the rolling hills of Scotland. Later, with the camera trained on the glass, a tiny explosion flung match-sized sticks into the air a foot or so beyond the glass. Next morning, this scene was thrown onto the translucent screen while the actor stood in the foreground watching the distant blast. Here was a rare combination of a miniature (the explosion), a glass painting, and the projection process—trick photography at its finest.

MINIATURES often serve as backgrounds for very dramatic action. A two-foot model ship, filmed as it tosses in a tank by a high-speed camera and thrown on the projection screen many times enlarged, looks for all the world like a seagoing vessel wallowing in a storm. When two men in a small boat, pitched about in a tank of water, are shown in the foreground vainly endeavoring to save themselves, you have a much more realistic scene than could be made under natural conditions. Too, this synthetic shipwreck can be photographed, whereas cameras would be useless on a dark sea.

One director wanted recently to show a dog under the influence of alcohol for a comedy scene. A cameraman solved the problem of controlling the animal by suggesting that its trainer cause it to run slowly while he filmed the movements at ten times normal speed. When I viewed the scene in a studio projection room, the dog seemed to be floating grotesquely down a village street.

No matter what effect is desired, some cameraman always finds a way to produce it. Unreality becomes reality when the wizards of celluloid attack problems of photography for modern movie making.

Amateurs Invade the Airways

(Continued from page 31)

away from traffic jams and the restrictions of the road; able to go where you please, whenever you please, with greater speed than express-train travel and with the freedom from soot and dust of a trip at sea! Wasn't it an alluring picture?

It sounded good, but I wasn't too sure. All I knew about flying as far as personal experience was concerned, dated from one "five-minutes-for-five-dollars" ride aloft as a sightseer. Suddenly being faced with the prospect of piloting a plane myself would give me a first-class case of jitters. Even granted that I might learn to run the thing, how would I know when the weather was safe for flying? How would I find my way, with no road signs to guide me? What would I do if something went wrong with my plane while I was in the air? To come out of the clouds and be more practical for a moment, could I afford to fly a plane at all? Patiently and in the fullest detail, veteran private flyers answered my questions.

ONE big item of expense in taking up flying, I learned, is the cost of instruction. You can skimp on this, to be sure, but old hands at the game consider it false economy. Many mishaps of private flyers, they say, can be traced directly to lack of the experience that a good flying course will give you. At a Government-approved school, this training will cost you somewhere in the neighborhood of $700. It includes the number of hours of dual-control and solo flying required for a Department of Commerce private pilot's license, which entitles you to fly your plane anywhere and to take up your friends or any other nonpaying passengers.

What you pay for your plane depends upon your preference in flying craft. You have thirty-five different makes to choose from, as varied in design and price as the motor cars currently offered to the public.

You can buy a plane for as little as $1,200—a tiny, open-cockpit affair that looks more like a toy than a real man-carrying machine. It is a fair-weather craft; because of its lightness, it is tossed about like a butterfly in rough air. Its forty-horsepower motor isn't powerful enough to give it much speed, and speed is one of the principal arguments put forward for airplane travel. It has one decided advantage, however—it can use a much smaller landing field than a more powerful and faster craft. If you aren't in a hurry, and are careful about picking your weather, you can fly about the country in one of these planes to your heart's content.

As a motorboat compares with a canoe, so one of the most popular of the airplanes used by private flyers compares with the one just described. This four-place, cabin machine sells for $6,485. Its 225-horsepower motor speeds it through the air at 140 miles an hour. Reclining in luxuriously upholstered seats, the owner-pilot and his passengers converse at their ease, undisturbed by the sound of the engine. The pilot operates controls like those of a motor car; an electric starter makes it unnecessary to spin the propeller by hand, and a wheel replaces the conventional control stick. To counteract the naturally high landing speed of a craft of this type, it is provided with "vacuum wing flaps" and hydraulic wheel brakes that bring it to a stop with a roll of only 250 feet on the ground. Short of a multimotored air yacht, a plane like this offers the last word in flying convenience and comfort.

Somewhere between these two you may find a ship that suits your purse. What will it cost to fly? Assume that you fly 250 hours a year, in a three or four-place machine of 150 to 250 horsepower and you may expect the operating cost to be about six dollars an hour or between four and five cents a mile. Aside from depreciation, all expenses are included in this figure—gasoline, oil, hangar rent, maintenance, and insurance. It represents a reduction in flying cost of about twenty-five percent within the last five years. Fixed expenses, such as hangar rent and insurance, will make it necessary to revise the estimate given if you fly much more or less than 250 hours yearly. Hangar rent alone amounts to from fifteen to thirty-five dollars a month, depending on the size of your plane and the locality where you store it.

Both the cost of buying a plane and of flying it can be reduced by forming a group to share expenses. Many aviation enthusiasts who could not otherwise afford to fly have clubbed together, bought a plane, and divided the cost of its operation among them.

What of aviation's future, as far as the average man is concerned? To make aviation really popular, an outstanding need is a cheap, foolproof, "flivver" plane. Whether the cost of such a craft can be pared to as little as $700, as Government officials hope, remains a much-debated question. Meanwhile, however, the U. S. Bureau of Air Commerce has taken the lead in coöperating with designers to produce radical new types of craft, especially suited to private use.

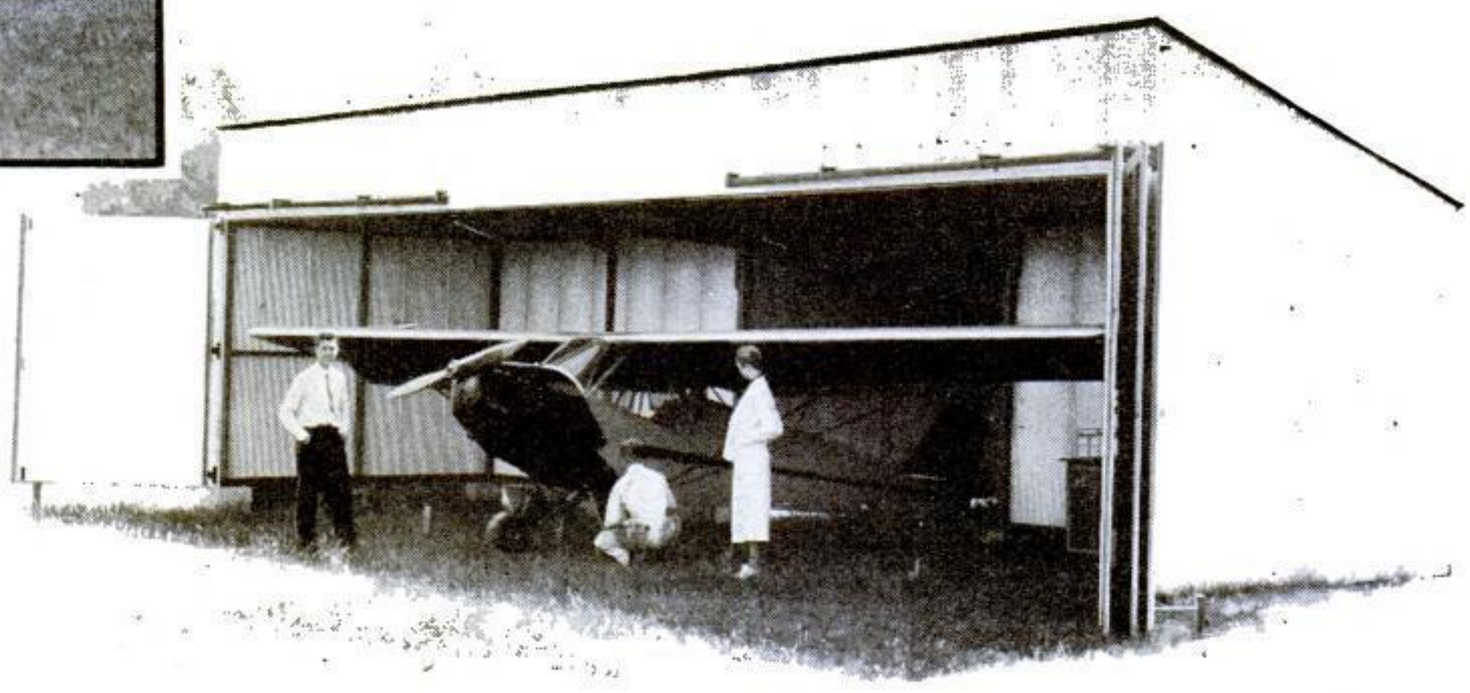
An interesting safety feature of several of these experimental planes is an auxiliary landing wheel, set at the extreme front of the machine to keep it from turning a forward somersault after a bad landing. Another is unusual visibility for the pilot, which is provided by installing a "pusher" propeller behind the cabin instead of mounting the airscrew at the front. One of the most successful of the new planes so far tested, a curious tailless model, offers both these features and also dispenses with a rudder, making it necessary for a pilot to master the use of only two controls instead of the usual three.

NEARING completion for its Bureau of Air Commerce trial, at this writing, is one of the strangest of hybrid aircraft—a "roadable autogiro" that can alight, fold its windmill blades, and travel along the road under its own power like an automobile. A special transmission shaft connects the engine with the tail wheel for this purpose. An owner could store this craft in his garage and drive it between his home and the airport. If forced to alight in a field too small for a take-off, he could roll away without requiring a tow.

Powering airplanes with automobile engines has interested Government officials as a possible means of reducing their cost. Critics point to the excessive weight of motor-car engines, compared with airplane-type designs of equal power. They admit the possibility, however, that forward-looking automobile manufacturers may start putting airplane engines in their cars! In such a case, lightweight motors would become available at mass-production prices for airplanes as well.

Whatever the outcome of current experiments in developing new planes and motors, it is evident that would-be flyers are not sitting idly by, awaiting the results. Each year is augmenting the ranks of amateur pilots, and today private flying seems on the verge of the greatest boom that the aviation world has ever seen.

Weighing only 200 pounds, this odd plane invented by a Pennsylvania man is said to be capable of carrying a load equal to its own weight. Its twenty-five-horsepower engine drives it at a mile-a-minute clip, and it can fly for an hour on two gallons of gasoline

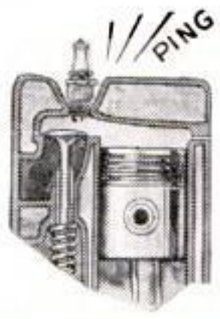


Portable metal hangars like the one pictured at the right simplify the problem of housing the privately owned airplane. Easily assembled in a few hours, such a hangar can be placed on rented ground handy to an airport or a landing field

HERE'S THE DIFFERENCE ETHYL MAKES

in 43 seconds

BEWARE a "pinging" sound this summer when you "step on the gas" for pick-up, or hills. It is your engine's way of saying: "I feel hot weather, too. I'm *losing* power, *wasting* gas and *overheating*. Give me better gasoline."

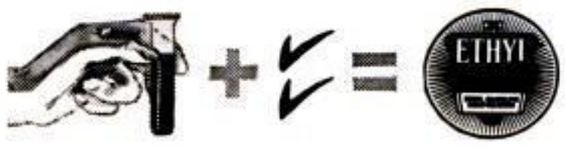


KNOCK is the name of that warning "ping." It occurs when a gasoline breaks down (burns too quickly) under the heat of a modern high compression engine.

Cars built in recent years have high compression engines. And in summer the knocking evil is at its worst because hot weather increases engine heat.

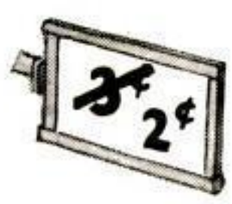
THE CURE—and preventive—of knock is better gasoline. That is why most oil companies now improve gasoline by adding anti-knock fluids (containing tetraethyl lead) made by the Ethyl Gasoline Corporation.

They recommend, as their *best* fuel for summer driving, special gasoline sold at pumps marked "Ethyl" on the base or on the globe.



YOU GET at the "Ethyl" pump:

- *Enough anti-knock fluid to stand up under the highest engine compression on the hottest day.*
- *All-round quality that is* double-checked — *by the oil companies and the Ethyl Gasoline Corporation — at the refinery and at the pump.*



DOWN TO 2¢ a gallon over regular gasoline—and high above it in anti-knock (high compression) value.

Give your car the *coolest* fuel this summer. Avoid the evil of knock, with its power loss, gasoline waste and overheating. Get more power from each gallon of gasoline you buy!...

NEXT TIME GET ETHYL